

Plantar fasciitis: A review of treatments

Lindsey Luffy, MSPAS, PA-C; John Grosel, MD; Randall Thomas, DPM; Eric So, DPM

ABSTRACT

Plantar fasciitis is the most common cause of heel pain in the United States. Many treatments are available and differ in efficacy and cost. This article discusses the theorized causes for plantar fasciitis and various treatments.

Keywords: plantar fasciitis, heel pain, fascia, microtears, sports medicine, podiatry

Learning objectives

- Identify the pathological findings of plantar fasciitis on imaging studies.
- Describe the typical presentation of a patient with plantar fasciitis.
- List the commonly used treatments to manage symptoms of plantar fasciitis and compare these to methods aimed at healing the injured fascia.

A 53-year-old woman presented to the podiatrist with a 1-year history of heel pain in the right foot that has worsened in the last 2 months. This is the first time she has been seen for this complaint. She reports that the pain has been intermittent for the past year but more consistent and bothersome in the past 2 months. She describes the pain as sharp and burning. The pain worsens when she rises from a seated position or during the first few steps in the morning. She has attempted treatment with ice and ibuprofen with minimal relief. She has a history of gout in the left first metatarsophalangeal joint.

The patient has tenderness to palpation along the medial band of the plantar fascia and at its origin on the medial calcaneal tubercle, as well as mild edema in this region.

Lindsey Luffy is a recent graduate of the PA program at Marietta (Ohio) College and a critical care PA fellow at Riverside Methodist Hospital in Columbus, Ohio. **John Grosel** is an associate professor and academic coordinator of the PA program at Marietta College and practices at Riverside Radiology and Interventional Associates, Inc., in Columbus, Ohio. **Randall Thomas** is assistant director of the foot and ankle surgery residency program at Clintonville Dublin Foot & Ankle Group at Grant Medical Center in Columbus Ohio. **Eric So** is a resident at Grant Medical Center. The authors have disclosed no potential conflicts of interest, financial or otherwise.

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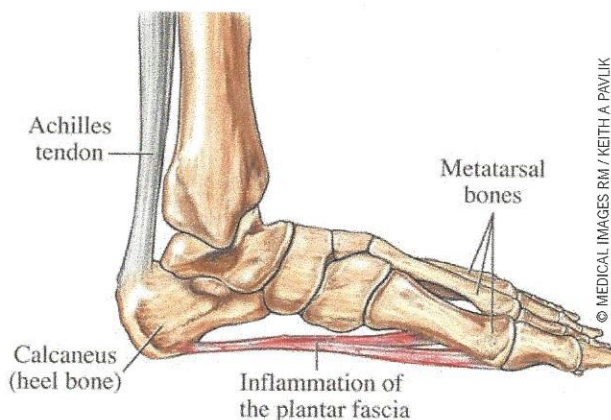


FIGURE 1. Lateral view of plantar fasciitis, an inflammation of the plantar fascia ligament, on the sole of the left foot.

She has tightness in the posterior calf and gastrocnemius equinus contracture.

Bilateral anterior-posterior and lateral radiographs revealed a calcaneal enthesophyte at the origin of the plantar fascia on the right foot. In-office ultrasound was performed and the plantar fascia was grossly thickened at its insertion. The patient was diagnosed with plantar fasciitis. She was fitted for custom orthotics and given stretching instructions. However, her pain was only improved by 50% with orthotics and stretching, so night splint therapy was added to her treatment plan. By her second follow-up, 6 weeks after presentation, she returned pain-free.

ABOUT PLANTAR FASCIITIS

The plantar fascia is a band of connective tissue originating at the calcaneus and inserting on the tendons of the forefoot and proximal phalanges (Figures 1 and 2), with the purpose of supporting the arch of the foot and acting as a shock absorber for pressure placed on the foot.^{1,2} Plantar fasciitis is a degeneration of the plantar fascia as a result of repetitive microtears of the fascia that lead to an inflammatory reaction, and is not a primary inflammatory process that most believe it to be.¹ The cause of plantar fasciitis is unknown but is believed to be multifactorial, with abnormal biomechanics and delayed healing as likely contributors.^{2,3}

Risk factors for plantar fasciitis include excessive foot pronation or flat feet (pes planus), high arches (pes cavus), tight Achilles tendon or gastrocnemius muscle (equinus),

Key points

- Plantar fasciitis is the most common cause of heel pain in the United States, affecting more than 2 million people.
- Conservative treatment is successful in up to 90% of patients.
- Invasive treatments such as corticosteroid injections are most risky and costly. Surgery is considered a last resort.

tight intrinsic foot muscles, limb length discrepancy, obesity, running, prolonged standing or walking, poor-fitting shoes, and improper gait.⁴

Nevertheless, plantar fasciitis is the most common cause of heel pain in the United States with more than 2 million people per year seeking treatment.¹ Though most patients' pain will resolve within 1 year regardless of treatment, most will seek treatment before then.³ Many treatments are available and most providers choose to begin conservatively, which is effective in 70% to 80% of patients.^{1,2} However, due to the high prevalence of plantar fasciitis (about 4% to 7% of the population), an estimated \$284 million is spent each year on plantar fasciitis treatments.¹ With the current cost-containment climate of healthcare, providers must be conscientious of the costs of various treatments.

PRESENTATION

Many patients complain of *post static dyskinesia*—heel pain in the morning or after rising from prolonged sitting, with relief upon initiation of movement. Physical examination will reveal pain to palpation of the medial plantar calcaneal region, pain with dorsiflexion, and tightness of the Achilles tendon or the gastrocnemius muscle.



FIGURE 2. Cadaver image showing origin of the plantar fascia (red line at heel), insertion of plantar fascia (red line at metatarsals), and medial aspect of plantar fascia (blue line)

MAKING THE DIAGNOSIS

Plantar fasciitis most often is a clinical diagnosis, although imaging can confirm the diagnosis or rule out other causes of heel pain. Plain radiographs can rule out bony lesions or stress fractures and may help determine the relative chronicity of the disease (Figure 3).⁴ Ultrasound is another relatively inexpensive diagnostic tool that can rule out certain causes of heel pain (such as plantar fibromatosis, foreign body, and plantar xanthomas) and can aid in diagnosis by establishing plantar fascial thickness and the presence of fascial tears (Figure 4).⁵

Several authors have reported the thickening of the plantar



FIGURE 3. Lateral foot radiograph showing a calcaneal spur (arrow) at the insertion of the plantar fascia

fascia and hypoechoic changes as characteristic features of plantar fasciitis.⁶ Multiple studies have verified that in patients with symptomatic plantar fasciitis, the plantar fascia thickness tends to be greater than 4 mm on diagnostic ultrasound.⁷ Conversely, costly CT scans are rarely ordered to diagnose plantar fasciitis but often the diagnosis is found incidentally on scans performed for other indications (Figure 5). Lastly, MRI is expensive but does show increased thickening of the plantar fascia, tendinopathy, tears, and all of the anatomy in greater detail (Figure 6).³ In general, making the diagnosis is straightforward; the challenge is finding an effective and economic first-line treatment.

TREATMENT OPTIONS

Although for many patients, pain is self-limiting and resolves within a year, the effect of heel pain on activities of daily living prompts patients to seek treatment before the pain resolves. Between 70% and 80% of patients have reduced pain with conservative treatment alone.¹ Nevertheless, many patients will require a combination of conservative treatment with other therapies.⁴

Conservative treatment These measures, which should be the initial treatment attempts, include rest or activity modification of the affected foot to allow time for healing. Another option is applying ice directly to the foot to decrease inflammation and associated pain. Finally, and likely the most commonly used initial treatment, is medication therapy with nonsteroidal anti-inflammatory drugs (NSAIDs), which also addresses the inflammation associated with plantar fasciitis.⁴ Other medical therapy options include acetaminophen or corticosteroids.^{1,4} These measures are less costly and invasive, but often only provide temporary relief.⁴

Stretching A popular, effective, and low-cost treatment, stretching for the plantar fascia and Achilles tendon often is the initial treatment for plantar fasciitis. Jha and colleagues compared plantar fascia stretching to Achilles tendon stretching. Both regimens improved heel pain, but

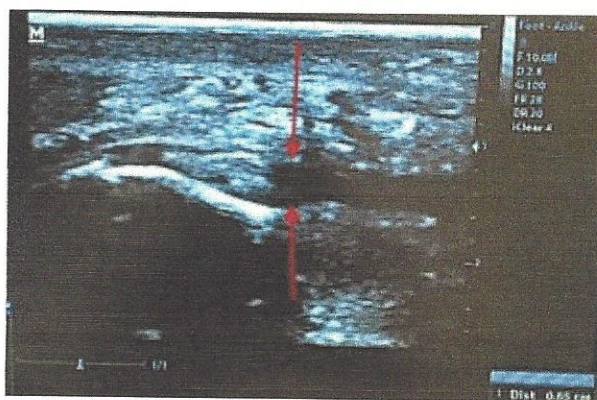


FIGURE 4. Sagittal ultrasound of the heel at the origin of the plantar fascia showing thickened fascia (arrows)

greater relief was provided by the plantar fascia-specific stretches. Most podiatrists and orthopedists specializing in foot and ankle can instruct their patients on stretching but some providers may choose formal physical therapy. Physical therapists may choose to keep patients in a structured program or may give them an at-home program to follow. Many physicians believe that stretching is a successful treatment because it addresses plantar fasciitis caused by tight gastrocnemius and intrinsic foot muscles.⁸

Orthotics and night splints Another commonly used treatment is orthotic insoles. Orthotics can be bought over-the-counter (OTC) or be custom-made; studies have found both equally effective and OTC orthotics are less costly.² A low-cost alternative to orthotics are silicone or plastic heel cups and arch supports. These treatments are believed to effectively treat the underlying biomechanics of plantar fasciitis, such as foot pronation, flat feet, and high arches, thereby reducing the peak plantar pressure.² Night splints, worn while patients are sleeping to prevent the foot from resting in a plantar-flexed position, also successfully treat plantar fasciitis. Splinting increases calf and plantar muscle flexibility and reduces tension on the plantar fascia during the first steps of the day.

A study by Lee and colleagues compared orthotics alone with orthotic use in conjunction with night splint use.² Orthotics alone were more effective in alleviating heel pain than the traditional conservative treatments.² However, greater success was found when night splints were used in conjunction with orthotics, compared with orthotics alone.² However, applying the night splint can be cumbersome, some patients may not tolerate the continuous stretching, and adherence issues can reduce the splint's efficacy. Wheeler and colleagues found that adherence to night splint use was a problem because patients lost sleep when first using the device.⁹ However, after 1 week of night splint use, patients' sleep patterns returned to baseline.⁹ Thus, orthotics should be an initial treatment considered by providers but if orthotics alone do not deliver full resolution of symptoms, providers can consider adding a night splint.



FIGURE 5. Sagittal reformatted CT scan of the foot in soft tissue window with an incidental finding of a thickened plantar fascia (arrow)



FIGURE 6. Sagittal fat-saturated MRI with contrast indicating acute on chronic plantar fasciitis as demonstrated by thickened plantar fascia with overlying hyperintensities (arrows)

Plantar injections The treatments discussed thus far are noninvasive and inexpensive. Although pain relief may not be immediate, symptoms tend to improve with time. Several invasive treatments exist but carry more risk and higher costs. Corticosteroid injections are one of the most popular invasive treatments for plantar fasciitis. Other types of injections include platelet-rich plasma and autologous blood. Although invasive, injections have few complications, most commonly postinjection pain and (rarely) fat pad atrophy, infection, nerve injury, and plantar fascia rupture.¹⁰

• **Corticosteroid injections.** A study performed in the United Kingdom compared corticosteroid injections with placebo and determined that corticosteroid injections provided short-term relief lasting no more than 1 month.¹⁰ Another study compared ultrasound-guided technique with corticosteroid and placebo injections. This study concluded that pain was improved for 1 month with the corticosteroid injection and plantar fascia swelling was reduced for up to 3 months compared with placebo.¹¹ Corticosteroid

injections can be costly and increase the risk of plantar fascia rupture. For these reasons, they mainly are used as short-term treatment, though some providers consider them first-line.¹⁰

- **Platelet-rich plasma injections.** A natural source of reparative growth factors to aid in healing, platelet-rich plasma can be used to restore and regenerate the plantar fascia. However, clinical results are equivalent to previous treatments but there is additional concern about cost and instrumentation requirements for making the platelet-rich plasma. Akşahin and colleagues compared corticosteroid injections with platelet-rich plasma injections and found no significant differences in outcomes.¹²

- **Autologous blood injections.** These injections are similar to platelet-rich plasma injections but use the whole blood product instead of only the plasma. Autologous blood injections are a newer treatment and have not yet been studied thoroughly. One of the few studies revealed that 85% of patients had improvement and 68% remained pain-free at 12-month follow-up.¹³

Despite the scarcity in the literature about platelet-rich plasma injections and autologous blood injections, the scientific concept behind their therapeutic effects makes sense. These injections treat degeneration of the plantar fascia by providing growth factors from the patient's blood to promote healing, compared with corticosteroids, which mainly provide pain relief. Initial studies show promising results, but lack of research, cost, and limited availability remain issues.^{12,13}

Extracorporeal shock wave therapy (ESWT) For patients with plantar fasciitis pain that does not respond to the previously described treatments, ESWT, introduced in the 1990s, may be an option. In this treatment, high-energy sound waves produce injury that promotes neovascularization and healing with local growth factors. The main

Understanding treatment options can reduce the economic burden of plantar fasciitis.

risk of this treatment is permanent damage of the fascia if excessive pressure is applied. In a recent study of ESWT, patients were given between four and eleven sessions of therapy, with an average of 2,000 pulses per session. The results were significant reduction of pain at 1 month, 3 months, and 1 year, with a pain intensity rating that continued to decrease as time went on. Treatment success rate was 98% at 1 year (measured as at least a 60% reduction in pain) with an 8% rate of symptom recurrence.⁵

Radiation therapy This treatment is thought to have anti-inflammatory effects that reduce inflammatory mediators and pain. However, radiation carries a small risk for

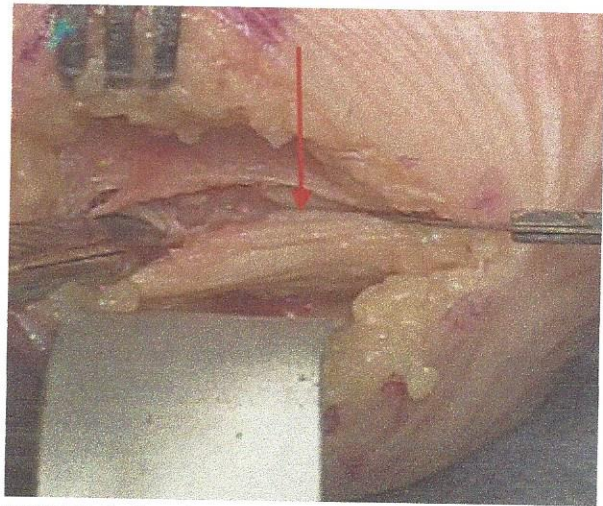


FIGURE 7. Cadaver image of plantar fascia as viewed from medial approach incision before fasciotomy

carcinogenesis. In a study comparing corticosteroid injections with radiation therapy, patients received radiation 3 days per week for 2 weeks with follow-up at 3 and 6 months. At both follow-ups, patients who received radiation therapy had significantly lower pain scores than those who received corticosteroid injections. Consider radiation if other treatments fail.¹⁴

Surgical options Consider surgery if the patient has continued pain after 6 to 12 months of nonsurgical management. Options include partial or complete plantar fascia release and gastrocnemius release. These surgeries may be performed as open or endoscopically; open partial fasciotomy is the traditional approach and poses the least amount of risk (Figure 7).³

Surgery is not a definitive resolution to plantar fasciitis, and results are highly variable.¹ Complications from surgery include infection, nerve injury, and plantar fascia rupture. Recovery time can be as long as 3 months and some patients may not return to baseline or may not have complete resolution of pain.³ Monteagudo and colleagues found that 60% of patients who had partial plantar fasciotomy had symptoms improvement, compared with 95% of those who had complete gastrocnemius release.³ Additionally, the patients with a proximal release had an average recovery of 10 weeks, compared with 3 weeks for patients with gastrocnemius resection.³

Though not a first-line treatment, surgery is an option with reasonable success in patients with unresponsive plantar fasciitis. Practitioners prefer surgical techniques that are minimally invasive and open versus percutaneous (Figure 8). Each procedure has a different perioperative protocol and should be discussed at length with the patient regarding expected outcomes. The typical postoperative course includes 3 weeks of immobilization and another 3 weeks of partial weight bearing. This may prevent the

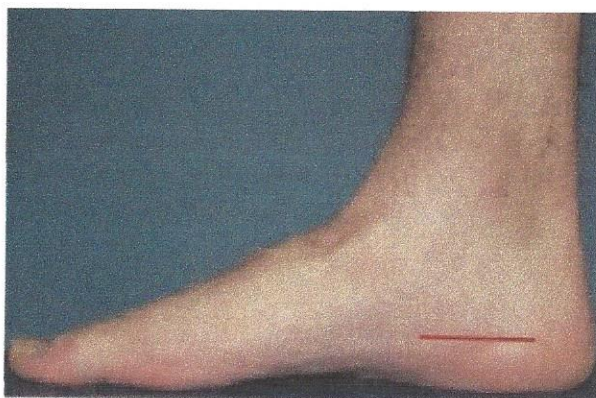


FIGURE 8. Incision site for medial approach to open fasciotomy (red line)

patient from returning to work and may change activities of daily living. Additional costs include the chance of postoperative complications requiring additional intervention. These hidden costs may have significant effect on the patient's quality of life and the economic burden to the healthcare system.

ECONOMICS OF TREATMENT

The most recent economic study revealed that the annual costs of plantar fasciitis are \$284 million.¹ That does not include opportunity cost from lost work and wages, societal burden, and psychologic burden. The typical cost per visit is about \$50 and the average cost of prescription NSAIDs, a common first-line treatment, is nearly \$600 per patient per year.¹ Noninvasive treatments such as orthotics and night splints cost about \$500. However, noninvasive treatments are not always successful and 10% of patients have refractory pain requiring more invasive treatment.² Fasciotomy procedures, for those patients who have already attempted and spent money on conservative treatment, can cost an additional \$300 as an outpatient to almost \$10,000, depending on comorbid conditions requiring inpatient stays.¹ By educating providers on the cost-effectiveness of treatment options, the economic burden of plantar fasciitis can be reduced.

CONCLUSION

Plantar fasciitis is the most common diagnosis of heel pain. Almost \$300 million per year is spent on treatments in the United States. Patients most often complain of heel pain that is worse in the morning or after a long period of sitting, and diagnosis is usually made on the basis of history and physical examination. Treatments should begin conservatively with stretching and can be supplemented with formal physical therapy if needed. Other first-line noninvasive treatments include NSAIDs and orthotics. A night splint can be added, though compliance is poor and cost is relatively high. If symptoms have not improved after these options, injections may be considered. If patients'

symptoms continue to persist for more than 6 months then ESWT or radiation could be considered. Surgical release typically is a last resort.

Plantar fasciitis is common but treatable. Patients will appreciate a knowledgeable provider who takes into consideration the expense and efficacy of the various treatments available for this condition. **JAAPA**

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