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Sports Medicine and Arthroscopic Surgery of the Foot and Ankle

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Chapter 7
Plantar Fasciitis

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7.1 Introduction

Plantar fasciitis is one of the more common injuries in the general population and can be debilitating for an athlete. In a retrospective study of 2002 running injuries, it was a found that 157 of the injuries were plantar fasciitis (7.8%) and another study found that there are more than one million patient visits per year to medical professionals.[1,2] The plantar fascia is the main supporting structure of the foot and arch; it is vulnerable to injury.

Plantar fascia injuries typically occur from overuse with an insidious onset, though they can happen acutely without prodromal symptoms. Patients may not seek treatment until the injury becomes more chronic in nature. It is commonly cited that the majority of the time fasciitis resolves with conservative treatment with studies showing relief of symptoms between 46% and almost 100%.[3-6]

Clinical examination is of utmost importance in the diagnosis and treatment of plantar fasciitis. Diagnostic testing may include plain radiographs, ultrasound and magnetic resonance imaging (MRI). Differential diagnoses may include stress fracture of the calcaneus; nerve-related injuries including tarsal tunnel syndrome, neuroma, and neuritis of the first branch of lateral calcaneal nerve; soft tissue mass; bursitis; fat pad atrophy; systemic arthritidies; tumors; and ruptures of the fascia.

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7.2 Anatomy

The plantar fascia attaches distally at the sulcus of the foot and runs along the plantar surface of the foot with three insertions in the plantar calcaneus: medially, centrally, and laterally. Bøjsen-Möller and Flagstad described the structure as being triangular with the base proximal.[7] Pontious et al. described the fascia as a dense band of fibers with the lateral and medial bands simply being coverings of the abductor hallucis and abductor digiti minimi muscles while the central portion is the most prominent and considered to be the true plantar aponeurosis.[8] The attachments of the medial and central portions are the most common locations of plantar fasciitis symptoms near the medial calcaneal tubercle (Fig. 7.1).

7.3 Clinical Findings

Plantar fasciitis has a classic presentation of pain with ambulation after rest, also known as post-static dyskinesia. Athletic patients may feel more discomfort in the "warm-up" phase of their activity; symptoms may subside after a few minutes of initiating their sport. In the early stages in the injury, the pain will subside after a few minutes or even steps, but in the chronic stages, the pain may not subside with ambulation at all. There is often a point of maximal pain at the plantar medial aspect of the calcaneus.

Patients may or may not be able to relate a causative factor for the onset of the pain. Literature review fails to identify an exact cause or foot type for this injury, but theories for the etiology of this injury include pes cavus, pes planus, overpronation, underpronation, excess weight, improper shoe gear, training errors, ankle equinus, lack of proper fat padding, and occupations that require standing for long periods of time.

Plain radiographs may show the presence of a calcaneal heel spur. The spur has little effect on the cause or treatment of plantar fasciitis. Radiographs may be of clinical importance in ruling out fracture, erosive changes associated with a systemic

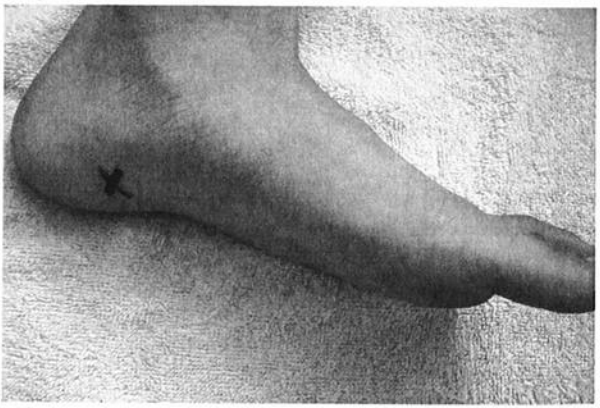

Fig. 7.1 Typical location of plantar fasciitis

arthritis or bone tumors. MRI and diagnostic ultrasound will show thickening of the fascia to at least twice the normal thickness[9,10] (Fig. 7.2).

7.4 Plantar Fascia Rupture

Rupture of the fascia may follow chronic long-term plantar fasciitis, occur acutely, or as a sequella of treatment such as after injection.[11-14] Most often the patient will relate feeling a pop or sudden sharp pain at the insertion of the medial or central band. Saxena and Fullem found an average return to activity of 9 weeks for athletes following this injury.[11] Patients often have bruising in the arch associated with the rupture (Fig. 7.3). Correlation of patients symptoms with the bruising is more than enough evidence of rupture but MRI provides more conclusive evidence (Fig. 7.4).

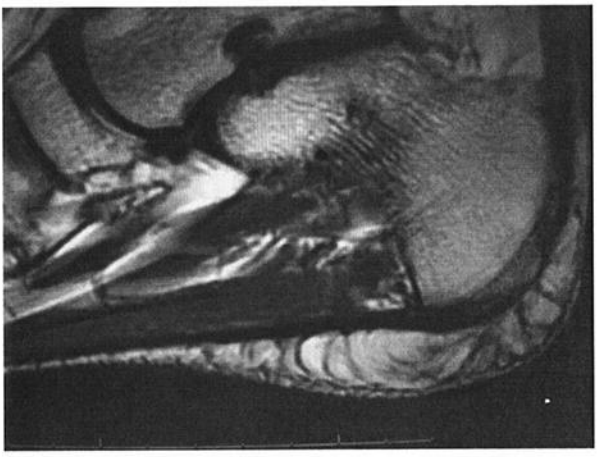

Fig. 7.2 MRI showing thickened plantar fascia

Fig. 7.3 Bruising associated with plantar fascia rupture

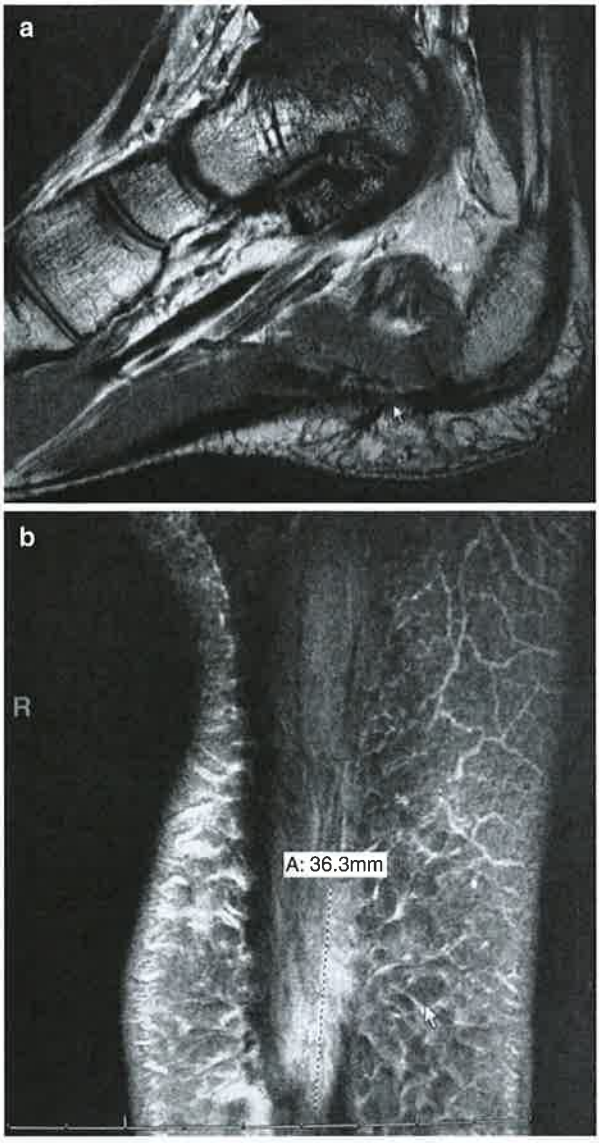

Fig. 7.4 (**a**) MRI sagittal view showing plantar fascial rupture. (**b**) MRI transverse view showing medial plantar fascia and abductor rupture

The treatment of a rupture differs greatly from the treatment of plantar fasciitis. Initial treatment should be aimed at reducing pain and inflammation through the use of non-weight-bearing, a below-knee walking boot, ice, and nonsteroidal anti-inflammatory drugs (NSAIDs) and/or narcotics if needed. Within 1–3 weeks, the patient should be able to progress to full weight-bearing in a boot and in another 1–3 weeks progress out of the boot to full weight-bearing. An arch support or foot orthosis placed inside the boot may be helpful. Physical therapy can be started very early in the process and should focus initially on helping to relieve symptoms through the

use of electrical stimulation (for swelling and pain control), pulsed ultrasound, and soft tissue mobilization. It should then progress to strengthening the foot and leg to transition out of the boot and back to full activity.[11]

7.5 Nonsurgical Treatment of Plantar Fasciitis

Since a majority of patients with plantar fasciitis get better with nonsurgical (conservative) treatment, it is worthwhile for presentation. There are no universal protocols to eliminate all the symptoms. Initial treatment, particularly in athletic patients, is to focus on stretching, reduce activity, and add arch support. Patient should perform a simple wall stretch concentrating on improving the flexibility of the gastrocnemius–soleus complex. The fascia does not have any elastic fibers and attempting to stretch the fascia by hanging off a step or putting your toes up against the wall may actually prolong the injury. However, DiGiovanni et al. presented an alternative method of non-weight-bearing specific stretching of the fascia which in their study worked better than the wall stretching.[15]

Ice can help control symptoms and is best performed by freezing water in a round smooth plastic bottle and rolling the foot over the bottle for at least 10 min, twice a day. Oral anti-inflammatories, both steroidal and nonsteroidal, can be utilized, though recent research has shown, as is the case with Achilles tendonosis, acute inflammatory pathological findings do not exist. If NSAIDs relieve symptoms, it is likely they are providing an analgesic effect. It may also be likely an arthridity is involved.

Avoidance of barefoot and adherence to wearing shoes with good arch support is also important in the initial treatment phase. Taping can be very effective at reducing symptoms and also may help aid in the diagnosis. Plantar fasciitis pain can be relieved the majority of the time through taping consisting of a low-dye with a Campbell's rest strap over the top of the low-dye. Patient can be instructed to perform the taping themselves before activity. Alternative taping can be variations of the "plantar figure-of-eight" method (Fig. 7.5). Immobilization can be recommended for chronic cases, though ideally this should be reserved for calcaneal stress fractures and plantar fascia ruptures.

Corticosteroid injection can be very effective at reducing symptoms but is not without risks. Plantar fascia ruptures have been associated with injections, and multiple injections in the same area can lead to fat pad atrophy.[12-14] The associated ruptures could possibly be dose and type-of-steroid related. Higher doses of insoluble steroids may have a more deleterious effect. Acevedo and Beskin reported that 10% of their patients were injected for plantar fasciitis with 40 mg/mL of triamcinalone acetate.[12] One author (BF) prefers a mixture of 1.0 cc of 25% marcaine, 4 mg of Dexamethasone phosphate, and 5 mg of triamacinalone acetate with fewer than10 post-injection fascial ruptures in 18 years of practice.

Over-the-counter arch supports should also be considered for the initial treatment phase. If symptoms persist, a custom orthotic device can be considered.

Fig. 7.5 Plantar "figure-of-8" taping. Additional reinforcement can be applied with traditional "low-Dye" taping

Fig. 7.6 Improper shoe flexibility predisposing plantar fascia or midfoot injury

A softer device should be used for the cavus/underpronated foot type while a more controlling device should typically be prescribed for the pes planus/overpronated foot type. Biomechanical examination and the patient's past experience should be combined with the physician's expertise to devise the best orthotic device. Examination of the athletic patient's shoe type is also paramount. Often sport shoes with arch cut-outs can instigate or aggravate plantar fascia conditions by allowing improper flexibility in the wrong region (Fig. 7.6).

Extracorporeal shock wave therapy (ESWT) is generally offered as a last resort in the United States before considering surgical management. Shock wave therapy is purported to ultimately work by improving the vascularization to the injured area. The treatment induces micro-trauma to the area, and during the repair process, new blood vessels develop to deliver nutrients to the area and heal the tissue. There are virtually no long-lasting negative effect from the treatment: cost and availability being the main deterrent in the United States. There are both high-energy and

Fig. 7.7 "Low-Energy" D-Actor™ Soundwave (Courtesy of Storz Medical AG, Taegerwilen, Switzerland. Used with permission)

low-energy machines. High-energy machines use a protocol of one treatment but requires anesthesia. Critics of this method cite that the painful area, when under anesthesia, may actually not be treated. The low-energy machines (Storz AG, Taegerwilen, Switerzerland) do not require local anesthesia, thereby allowing for "patient-focused or -directed" treatment (Fig. 7.7). Low-energy protocol requires three treatments usually spaced 1 week apart. Athletic patients being treated with low-energy machines are often able to continue their sport. Evidenced-based medical literature mainly finds long-term success rates of over 70%.[16-20] Some studies show a high percentage of benefit from placebo (greater than 40%).[17,21]

7.6 Surgical Management of Plantar Fasciitis

Failed nonsurgical therapy for at least 6 months is generally acceptable for consideration of surgical intervention in athletic patients. Less than 5% of patients meet the authors' surgical criteria: rest, inserts, injections, sound wave as described above, along with at least 6 months or more of symptoms. Based on the authors' findings that plantar fascia rupture patients do well if they are immobilized and kept non-weight-bearing post-injury, we propose that surgical treatment in essence produces the same result: reduced tension and an acute inflammatory response at the plantar fascia attachment.

Surgical approaches may include endoscopic plantar fasciotomy (EPF), "instep" fasciotomy, and the traditional open approach over the medial aspect of calcaneus. There are advantages and disadvantages to each technique and surgeon preference should always be considered. The decision to perform surgery on an athletic patient is probably more critical than the actual technique. Based on the findings that patients with partial plantar fascia do well post-immobilization, the goal of surgery is to also create a "clean" partial rupture of the medial portion of the central plantar fascia band.[11] The concern of "weakening the arch" has not been clinically proven.[14,22]

In the absence of any nerve involvement, one author (BF) prefers the instep fasciotomy. This technique avoids the neurovascular bundle and has the advantage of being technically simple to perform. Woelffer and colleagues performed a retrospective analysis of 33 patients that underwent the instep fasciotomy and found at 5-year follow-up that 30 had good-to-excellent results.[23]

The instep fasciotomy procedure can be performed under local anesthesia. Boberg states "Proper placement of the incision is imperative to a satisfactory outcome".[24] The incision should be placed approximately 1 cm distal to the insertion at the heel, at the point where the arch begins to slope away from the calcaneus (Fig. 7.8). The central band can be identified in the arch and the incision should be placed over this portion of the fascia. A transverse incision is made and carried down to the level of the fascia. After identifying the medial and lateral border of the central band, the toes are dorsiflexed to place the fascia under tension and the fascia is severed. It is important to maintain the lateral band of the fascia to help avoid lateral column complications postoperatively. After irrigation, the wound is closed with a combination of simple and horizontal mattress sutures. The patient should be kept non-weight-bearing for a minimum of 2 weeks to facilitate proper healing of the skin incision and to allow the fascia to heal in an elongated state.

One can also perform a more traditional open approach which can incorporate a release of the first branch of the lateral calcaneal nerve, which is often implicated as a major cause of plantar heel pain. An oblique incision on the medial heel is placed from behind the medial malleolus near the junction of the medial skin and plantar fat pad, running into the plantar aspect of the foot. The fascia overlying the abductor hallucis muscle belly is incised and the septa in the porta pedis is also released allowing for a complete release of the first branch of the lateral calcaneal nerve. The fascia is then resected at the attachment and the plantar calcaneal spur is removed if present. It is advisable to keep deep closure to a minimum with emphasis on excellent skin closure technique with simple and interrupted mattress type sutures.[24]

Unfortunately, there is scant literature on performing plantar fascia surgery in athletes whether open, percutaneously, or endoscopically. Saxena reported on an

Fig. 7.8 Instep fasciotomy incision

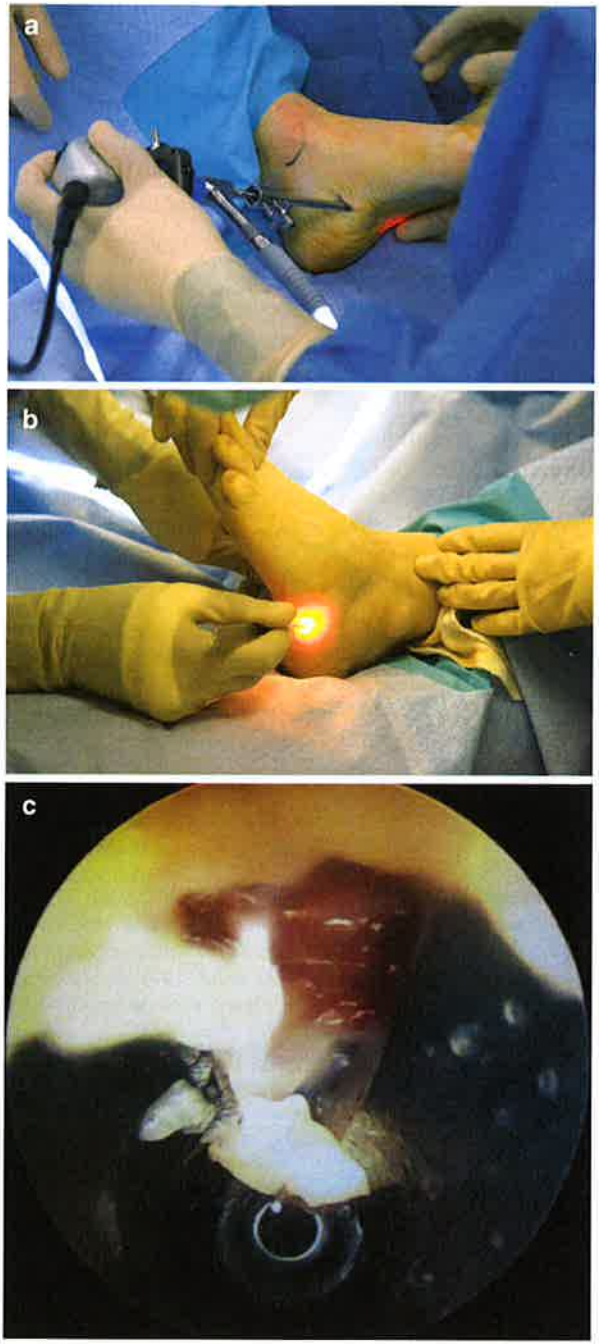

Fig. 7.9 (**a**) Medial endoscopic portal; (**b**) Lateral endoscopic portal; (**c**) Endoscopic view of medial portion of plantar fascia being cut

endoscopic approach on athletic patients in 2004. Overall, good and excellent results were obtained in over 90% of patients as long as their body-mass index (BMI) was <27.[22] The endoscopic approach had been criticized for inducing lateral column pain and nerve entrapment.[25] One author's (AS) preferred technique is the endoscopic approach. However, some critical differences are adhered to as compared to historical endoscopic approaches. With the two-portal approach using a 4.0-mm endoscope, only the medial one half of the central band is transected. A longitudinal lateral incision is made; so, the cannula is not placing undue tension on the lateral structures (Fig. 7.9). Postoperatively, patients are kept in a boot, non-weight-bearing for 2 weeks when skin sutures are removed, and then weight-bearing occurs for additional 2 weeks or until pain-free. This is critical as early weight-bearing may induce lateral compensation. Usually an arch support is used as well. Physical therapy is initiated at 5 or more weeks post-plantar fascia surgery. Return to sports with endoscopic technique can occur as soon as 7 weeks, but typically ranges around 12 weeks.[22]

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