

COMPLICATIONS OF PLANTAR FASCIA RELEASE

Michelle L. Butterworth, DPM

INTRODUCTION

Heel pain is one of the most common disorders that foot and ankle surgeons treat. Investigators have stated that of all adult foot complaints, 15% result from heel pain (1). It is important then that the physician know how to properly diagnose and treat this common problem. Although there are many etiologies of plantar heel pain, plantar fasciitis or plantar heel spur syndrome is the most common (2). Fortunately, conservative treatment is successful in roughly 90% of patients seeking treatment with this diagnosis (3, 4). These studies have shown that 6 months of quality conservative treatment should be attempted before surgery is considered.

When patients do not respond to conservative therapies, and their plantar heel pain persists, surgical options may be pursued. Surgical treatment for plantar fasciitis has been shown to be very effective with good results routinely reported throughout the literature (5-15). However, complications can be encountered, as with any surgical procedure, so the foot and ankle surgeon must know how to identify complications when they arise and instill a rapid, effective treatment plan.

HOW TO AVOID COMPLICATIONS

The best way to address complications is to avoid them. Many complications can be avoided by proper patient selection, accurate diagnosis, appropriate procedure selection, good surgical technique, and implementation of an appropriate postoperative regimen.

Patient Selection

As was stated previously, because of the high rate of success with conservative therapies for plantar heel pain, non-operative measures should be exhausted prior to surgical intervention. Sometimes patients want a quick fix to their problem and desire to proceed with surgery in an expeditious manner. It is the physician's responsibility to ensure that appropriate conservative therapy is employed and not let the patient control their own treatment protocol. Some patients must also be willing to make certain lifestyle changes to ensure good results. This can be very difficult for many patients and they may view surgery as an easier option. These changes may include shoe modifications, weight

reduction, decreased activities, and employment alterations. It needs to be thoroughly discussed with the patient that even when surgery is employed, if some of these changes are not made, persistent pain may ensue.

Differential Diagnosis

Although plantar fasciitis or heel spur syndrome is the most common reason for plantar heel pain (2), the physician still needs to have a good working differential diagnosis, especially in recalcitrant cases. Other possible sources of plantar heel pain include but are not limited to neuritis or nerve entrapments, stress fractures, bone tumors, and metabolic entities such as systemic lupus erythematosus (SLE), rheumatoid arthritis, reactive arthritis, gout, psoriatic arthritis, ankylosing spondylitis, and inflammatory bowel disease. When a patient is not responsive to conservative therapy, the surgeon should consider the possibility of these other etiologies prior to surgical intervention or the surgery could be doomed to failure.

Surgical Procedures

When pursuing surgical intervention for plantar heel pain, the foot and ankle surgeon has several options. A plantar fasciotomy is the most common surgical procedure for plantar fasciitis but there are different techniques that may be employed (7, 9, 12, 13, 16-18). These techniques include open, endoscopic, minimal incision, and in-step plantar fasciotomies. All of these procedures have been shown to have good postoperative results with satisfied patients (8, 11). Regardless of which procedure the surgeon prefers, the proper amount of plantar fascia incised is one of the keys to a successful outcome and can avoid possible complications. Barrett and Day originally advocated complete resection of the plantar fascia (15, 16); however, 2 years later they recommended that only the medial 2/3 of the plantar fascia be released (17). With continued experience and evaluation of postoperative complications, their final recommendation is releasing only the medial 1/3 of the plantar fascia (9). The reason for the change in amount of plantar fascia to be cut is to reduce the common complication of lateral column destabilization. When the lateral fibers of the plantar fascia are left intact it is felt that the locking mechanism for the calcaneocuboid joint will not be disrupted. Cheung

et al (19) recommend partial release of less than 40% of the fascia to minimize the effect of arch stability and maintain normal foot biomechanics. Brugh et al (20) found that lateral column symptoms were more likely to result when more than 50% of the plantar fascia was released.

Surgical Technique

Besides releasing the proper amount of plantar fascia, incision placement is another important component to the success of the surgical procedure. For this reason, the medial in-step plantar fasciotomy is the procedure of choice for the author for chronic plantar fasciitis. This technique is easy to perform, has few complications, has a quick recovery and postoperative healing course, and the results are predictable with a high patient satisfaction rate (7,8).

Although the open procedure has been popular and still is by many surgeons, it can lead to larger, painful scars, requires significantly more dissection, has a longer postoperative recovery period, and can lead to other complications such as nerve entrapments (12, 21-23). Endoscopic plantar fasciotomy is also a very common procedure employed by foot and ankle surgeons and has been shown to have a high rate of success as well (9, 15-17). The portals however can become painful and nerve entrapment is also possible (24).

The in-step plantar fasciotomy is not without reported complications such as scarring as well (7, 8). Fortunately, the author has been able to avoid painful scarring with accurate incision placement. The incision is a small transverse incision, approximately 2 cm in length, in the proximal medial arch distal to the calcaneal fat pad about 1.5-2 cm. (Figure 1). This incision is ideal because it is in line with the relaxed skin tension lines and is on a nonweight-bearing surface so scarring is minimized. It can be tempting however, for the surgeon to make the incision too distal where the plantar fascia is more prominent. There is very little subcutaneous tissue in this area and scarring can be problematic at this location. Once the skin incision is made, there is usually minimal dissection needed before the plantar fascia is encountered and ready for release (Figure 2). Once the plantar fascia is incised, the underlying muscle belly should immediately be visualized (Figure 3). The author's preference is to release between $\frac{1}{3}$ to $\frac{1}{2}$ of the medial plantar fascia. The author keeps the digits dorsiflexed and releases the plantar fascia until the tension has resolved. The muscle septum may be encountered in the lateral aspect of the incision. The author does not incise this or cut any of the fibers of the plantar fascia lateral to this landmark. It is important however to ensure that all of the medial fibers of the plantar fascia are released. Since the incision is small, the



Figure 1. This displays the incision upon skin closure. The 2 vertical lines mark the medial and lateral aspects of the prominent band of the plantar fascia. The proximal horizontal line marks the distal end of the calcaneal fat pad. The actual skin incision is made about 2 cm (or 2 finger widths) distal to the horizontal line and between the 2 vertical lines.



Figure 2. Once the skin incision is made, little dissection is necessary before the plantar fascia can be visualized. This is a major advantage to this incision placement. There is enough subcutaneous tissue still present at this location however to help minimize any scarring or thickening the patient may feel.



Figure 3. Once the plantar fascia is incised, the underlying muscle belly is easily visualized. This ensures that all of the fibers have been transected.



Figure 4. A metzenbaum scissor is utilized to go under the skin incision to probe and then cut any taut bands that remain along the medial aspect of the plantar fascia.

author probes under the skin along the abductor hallucis muscle belly. If any taut fibers are encountered, they are incised with a Metzenbaum scissor (Figure 4).

Postoperative Course

Fortunately, patients undergoing a plantar fasciotomy, regardless of which surgical technique is employed, typically have a fairly quick healing and recovery time. The author's typical postoperative course following an in-step plantar fasciotomy is immediate weight bearing in a surgical shoe with limited activities. Walking places the plantar fascia under tension and allows the site of the plantar fasciotomy to remain open and avoid re-adherence and fibrosis of the site. Zimmerman et al (25) however, recommend a different postoperative course. They did a retrospective study comparing 3 types of postoperative management for endoscopic plantar fasciotomy. One group was allowed immediate weight bearing. A second group wore a below-the-knee walking cast with a molded medial longitudinal arch for 2 weeks. The third group remained nonweight bearing with crutches for 2 weeks. Their results showed that the patients who wore the below-the-knee walking cast for 2 weeks required less time to obtain 80% pain relief, needed less time to return to full activities, and had fewer complications than those patients who were allowed immediate weight bearing. They were also more satisfied with their postoperative results than the patients who were nonweight bearing for 2 weeks.

COMPLICATIONS

Even when a surgeon has operated on the ideal surgical candidate and has employed the best surgical technique, complications can still result. The physician has to identify the complication so that treatment can be instilled quickly and efficiently. As with any surgical procedure, complications may be encountered with a plantar fasciotomy, but fortunately, they are few in number and when complications are encountered most are usually temporary.

Instability

The most common complications encountered with a plantar fasciotomy are derived from instability; lateral column pain and instability being most pronounced (5, 9, 15-17, 26). When a plantar fasciotomy is performed, some degree of support to the foot is lost. There are numerous structures involved with this support besides the plantar fascia, including muscles and ligaments. This loss of support is usually temporary while the other structures adapt and accommodate to this loss. During this time patients can experience lateral column instability, sinus tarsi, medial arch pain and fatigue, metatarsalgia, and strain along the lesser tarsus. With continued strain, stress fractures may also arise.

There are many studies that discuss the biomechanical consequences with plantar fasciotomy. Tweed et al (27) found weakness of the medial longitudinal arch and pain

in the lateral midfoot in cadaver specimens with a total release. Sharkey et al (28) also report significant collapse of the arch in the sagittal plane with a complete fasciotomy. In a follow up study Sharkey et al (29) found that cutting only the medial half of the plantar fascia did significantly increase peak pressure under the metatarsal heads but had little effect on pressures in other regions of the forefoot or second metatarsal strain and loading. Dividing the entire plantar fascia however, caused significant shifts in plantar pressure and force from the toes to beneath the metatarsal heads and significantly increased strain and bending in the second metatarsal. What can be concluded then from these biomechanical studies is the same that has been concluded in the previous studies; cutting 50% or less of the plantar fascia should be performed in order to try to minimize postoperative instability.

All of the above are due to instability created by the procedure itself. During the healing process and fibrosis, the arch regains some stability and these entities are typically temporary. Fortunately, when these biomechanical instability problems are encountered they usually resolve with conservative measures. Biomechanical control postoperatively is very important as the foot accommodates to the temporary destabilization. Most patients usually have an orthotic device or arch support as part of their conservative therapy. The author recommends continued use of these devices postoperatively as well, especially when the patient is having symptoms of instability. Balance padding can also be added and can be beneficial particularly along the lateral column. Nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroid injections can also be utilized for inflammation. If pain from biomechanical instability continues even with these measures incorporated into the treatment plan, immobilization may be necessary.

Persistent Pain

Continued pain or continued plantar fasciitis is another possible complication. If a patient has persistent pain following a plantar fasciotomy, the physician should look for other possible etiologies for the pain. Neuritis or nerve entrapments, especially Baxter's nerve, are a possible source of continued pain. This nerve can be entrapped as it courses below the abductor hallucis muscle.

Although most inferior calcaneal spurs are not the source of heel pain in the majority of patients with plantar fasciitis, (22-24) ones with a large plantar protuberance or patients with a pes planovalgus foot type may have persistent pain requiring resection of the prominence. If a spur was removed during the initial surgery and heel pain persists, the patient should be evaluated for a possible calcaneal fracture. Resection of the spur can produce stress

risers, which can develop into a fracture with weight bearing. It is also possible that the patient had a calcaneal stress fracture prior to surgery that was never diagnosed.

Metabolic reasons including SLE, rheumatoid arthritis, reactive arthritis, gout, psoriatic arthritis, ankylosing spondylitis, and inflammatory bowel disease must also be among the differential diagnosis for recalcitrant pain post plantar fasciotomy.

Continued inflammation following a plantar fasciotomy may also be a source of continued pain. Once the plantar fascia is allowed to adequately stretch and the tension has been released along the insertion at the calcaneus, the inflammatory process usually starts to subside. This can be a slow process however, and anti-inflammatory measures including rest, ice, NSAIDs, and corticosteroid injections can be employed postoperatively if needed.

Complications from Surgical Technique and Postoperative Course

Besides complications resulting from altered biomechanics, scarring is one of the more common complications with a plantar fasciotomy; regardless of procedure selection. Again, the key to avoid painful, thickened scarring is good surgical execution and incision placement. Scarring can be minimized by making incisions within relaxed skin tension lines, making them parallel to the course of nerves to avoid neuritis or nerve entrapments, and keeping them on non-weight-bearing areas. When painful scars are encountered conservative treatments such as topical medications and massage, gel (Silicon) sheeting, and corticosteroid injections can be employed. Fortunately, many of the painful scars do resolve with time. For persistent pain, excision of the scar can be attempted. Also, if the scar is painful secondary to neuritis or nerve entrapment this must also be addressed. NSAIDs and corticosteroid injections are often helpful for neuritis however; nerve release and/or excision may be needed to relieve the symptoms of nerve entrapment.

Persistent pain may also result if not enough of the plantar fascia was released and tight fibers remain. It is also possible that although the plantar fascia was released, if the opening of the fibers are not maintained they can fibrose and reattach. Some surgeons take a small portion of the plantar fascia and perform a plantar fasciectomy to avoid this possible complication. Some surgeons employ immediate weight bearing postoperatively while others utilize splinting and casting to help keep the fibers of the plantar fascia separated. Stretching of the plantar fascia postoperatively may also be helpful to avoid this complication but care should be taken in not being overaggressive causing rupture. Also, if too much of the plantar fascia is released and an

active postoperative course is employed with weight bearing and stretching, one should be cautious of complete rupture. If it is felt that not enough of the plantar fascia has been released or there is scarring along the plantar fasciotomy site, revisional surgery with possible plantar fasciectomy may be warranted for relief of pain.

ALTERNATIVE TREATMENT

Although plantar fasciotomy has been shown to be a successful technique with few complications, extracorporeal shock wave therapy is a non-invasive alternative for the treatment of chronic plantar fasciitis and has been shown to have good results (30, 31). The surgeon should be aware of this technique and familiarize themselves with the risks and benefits compared to a plantar fasciotomy.

SUMMARY

Plantar fasciotomy has been shown to be a successful technique for recalcitrant heel pain. Few complications have been reported and fortunately, typically result with conservative therapies. Most complications are due to temporary instability produced in the foot from altered biomechanics resulting from the release of the plantar fascia. With proper patient selection, accurate diagnosis, and good surgical technique, complications can be minimized resulting in high patient satisfaction. For persistent pain revisional surgery may be needed and the patient may need to make lifestyle changes including possible weight loss, change in athletic routines, or even changes in employment.

REFERENCES

1. Michetti ML, Jacobs SA. Calcaneal heel spurs: etiology, treatment, and a new surgical approach. *J Foot Surg* 1983;22:234-9.
2. Contompasis JP. Surgical treatment of calcaneal spurs: a three year post surgical study. *J Am Podiatry Assoc* 1974;69:987-99.
3. Davis PF, Severud E, Baxter DE. Painful heel syndrome: results of non-operative treatment. *Foot Ankle Int* 1994;15:531-5.
4. Malay DS. Plantar fasciitis and heel spur syndrome: a retrospective analysis. In Vickers NS, et al. eds. *Reconstructive Surgery of the Foot and Leg: Update '96*. Tucker (GA): Podiatry Institute Publishing; 1996. p. 39-43.
5. Baxter DE, Thigpen SV. Heel pain: operative results. *Foot Ankle* 1984;5:16-25.
6. Anderson RB, Foster MD: Operative treatment of calcaneal pain. *Foot Ankle* 1989;9:317-23.
7. Perelman GK, Figura MA, et al. The medial instep plantar fasciotomy. *J Foot Ankle Surg* 1995;34:447-57.
8. Boberg JS. Heel pain. In: *Reconstructive Surgery of the Foot and Leg: Update '95*. Tucker (GA): The Podiatry Institute; 1995.
9. Barrett SL, Day AV, et al. Endoscopic plantar fasciotomy: a multi-surgeon prospective analysis of 652 cases. *J Foot Ankle Surg* 1995;34:400-6.
10. Sammarco GJ. Surgical treatment of recalcitrant plantar fasciitis. *Foot Ankle Int* 1996;17:520-6.
11. Brekke MK, Green DG. Retrospective analysis of minimal-incision, endoscopic, and open procedures for heel spur syndrome. *J Am Podiatry Med Assoc* 1998;88:64-72.
11. Benton-Weil W, Borrelli AH, et al. Percutaneous plantar fasciotomy: a minimally invasive procedure for recalcitrant plantar fasciitis. *J Foot Ankle Surg* 1998;37:269-72.
12. Stone PA, McClure LP. Retrospective review of endoscopic plantar fasciotomy-1994 through 1997. *J Am Podiatry Med Assoc* 1999;89:89-93.
13. Lundeen OL, Aziz S et al. Endoscopic plantar fasciotomy: a retrospective analysis of results in 53 patients. *J Foot Ankle Surg* 2000;39:208-17.
14. Barrett SL, Day SV, Brown MG. Endoscopic plantar fasciotomy: preliminary study with cadaveric specimens. *J Foot Surg* 1991;30:170-2.
15. Barrett SL, Day SV. Endoscopic plantar fasciotomy for chronic plantar fasciitis/heel spur syndrome: surgical technique – early clinical results. *J Foot Surg* 1991;30:568-70.
16. Barrett SL, Day SV. Endoscopic plantar fasciotomy: Two portal endoscopic surgical techniques – clinical results of 65 procedures. *J Foot Ankle Surg* 1993;32:248-56.
17. Ward WG, Clippinger FW. Proximal medial longitudinal arch incision for plantar fascia release. *Foot Ankle* 1987;8:152-5.
18. Cheung JT, An KN, Zhang M. Consequences of partial and total plantar fascia release: a finite element study. *Foot Ankle Int* 2006;27:125-32.
19. Brugh AM, Fallat LM, Savoy-Moore RT. Lateral column symptomatology following plantar fascial release: a prospective study. *J Foot Ankle Surg* 2002;41:365-71.
20. Graves RH 3rd, Levin DR, Giacopelli J, et al. Fluoroscopy-assisted plantar fasciotomy and calcaneal exostectomy: a retrospective study and comparison of surgical techniques. *J Foot Ankle Surg* 1994;33:475-81.
21. Tomczak RL, Haverstock BD. A retrospective comparison of endoscopic plantar fasciotomy to open plantar fasciotomy with heel spur resection for chronic plantar fasciitis/heel spur syndrome. *J Foot Ankle Surg* 1995;34:305-11.
22. Kinley S, Frascione S, Calderone D, et al. Endoscopic plantar fasciotomy versus traditional heel spur surgery: a prospective study. *J Foot Ankle Surg* 1993;32:595-603.
23. O'Malley MJ, Page A, et al. Endoscopic plantar fasciotomy for chronic heel pain. *Foot Ankle* 2000;21:505-10.
24. Zimmerman BJ, Cardinal MD, et al. Comparison of three types of postoperative management for endoscopic plantar fasciotomy. A retrospective study. *J Am Podiatry Med Assoc* 2000;90:247-51.
25. Fishco WD, Goecker RM, et al. The instep plantar fasciotomy for chronic plantar fasciitis. *J Am Podiatry Med Assoc* 2000;90:66-9.
26. Tweed JL, Barnes MR, et al. Biomechanical consequences of total plantar fasciotomy: a review of the literature. *J Am Podiatry Med Assoc* 2009;99:422-30.
27. Sharkey NA, Ferris L, Donahue SW. Biomechanical consequences of plantar fascial release or rupture during gait: part I-disruptions in longitudinal arch conformation. *Foot Ankle Int* 1998;19:812-20.
28. Sharkey NA, Donahue SW, Ferris L. Biomechanical consequences of plantar fascial release or rupture during gait: part II-alterations in forefoot loading. *Foot Ankle Int* 1999;20:86-96.
29. Weil LS Jr, Roukis TS, et al. Extracorporeal shock wave therapy for the treatment of chronic plantar fasciitis: indications, protocol, intermediate results, and a comparison to results to fasciotomy. *J Foot Ankle Surg* 2002;41:166-72.
30. Othman AM, Ragab EM. Endoscopic plantar fasciotomy versus extracorporeal shock wave therapy for treatment of chronic plantar fasciitis. *Arch Orthop Trauma Surg* 2009; December 24.