Mid-Sole Release of the Plantar Fascia Combined With Percutaneous Drilling of the Calcaneus for Treatment of Resistant Heel Pain

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Abstract

Background: Heel pain with or without calcaneal spur is a challenging problem. Once conservative measures have failed, surgery may be indicated; there has been debate about the best surgical procedure. Two standard operative procedures have been either releasing the plantar fascia or removing the spur with drilling of the calcaneus. In this study, we evaluated the results of percutaneous drilling of the calcaneus combined with mid-sole release of the plantar fascia for treatment of resistant heel pain.

Methods: This study included 20 cases with resistant heel pain after failure of conservative measures for 6 months. Clinical, radiological evaluation and scoring patients’ conditions according to the American Orthopaedic Foot & Ankle Society (AOFAS) Ankle-Hindfoot scale was done preoperatively and postoperatively. Percutaneous drilling of the calcaneus combined with mid-sole release of the plantar fascia was done in all cases, and the functional results were evaluated through the follow-up period that extended from 9 to 16 months with a mean duration of 12 ± 2.3 months.

Results: There was statistically significant improvement in the mean AOFAS Ankle-Hindfoot scale score from 50.8 ± 7.5 preoperatively to 91.6 ± 7 postoperatively at the last follow-up. There were no surgery-related complications, and the mean time for full recovery was 8 ± 3.7 weeks with no recurrence of pain by the last follow-up.

Conclusions: The results were very satisfactory with using this minimally invasive and simple technique for treatment for resistant heel pain.

Level of Evidence: Level IV, retrospective case series.

Keywords: resistant heel pain, mid-sole release of the plantar fascia, percutaneous drilling

Plantar heel pain is a widespread problem of many patients. Investigators have stated that 15% of adult foot complaints result from heel pain. Although the etiology and pathogenesis are not fully understood, plantar fasciitis and/or plantar heel spur syndrome are the most common causes while other probable causes such as nerve entrapment, abnormal foot mechanics, systemic conditions, or a combination of these factors can still be considered.¹⁶,²⁴

It is not uncommon to find cases not improved despite lengthy conservative treatment for 6 months or more; thereby, operative treatment may be considered. The type of procedure performed is somewhat dependent on what is believed to be the most important etiologic factor for heel pain (entrapment neuropathy, plantar fasciitis, and bone spur).²⁰ Many operative procedures have been tried with different details and results. The most commonly used procedures are release of the plantar fascia with or without calcaneal spur excision, Steindler stripping, neurolysis of the first branch of the lateral plantar nerve, and endoscopic plantar fasciotomy.¹⁷

DuVries,¹² through a medial linear incision, released the plantar fascia and removed the spur. Hassab and El-Sherif¹⁴ introduced calcaneal decompression with multiple drill holes from the medial to the lateral cortex of the calcaneus. These traditional surgeries were sometimes associated with complications such as numbness around the incision and medial heel, delayed healing of the wound, persistent swelling around the medial heel, violation of the plantar fat pad, and so on.

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Methods

The study was performed in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975. All patients gave informed consent before inclusion in the study; the study was authorized by the institutional review board.

This prospective, case series study was carried out in the orthopedic department at Benha University Hospital between January 2014 and February 2016 and included 20 cases in 12 patients with resistant heel pain. Patients with persistent or recurrent inferomedial heel pain after receiving nonoperative treatment for at least 6 months were included in this study while cases with a generalized inflammatory disorder (rheumatoid arthritis or sero-negative disorders), cases with any wound or skin lesion at the plantar aspect of the foot, and cases with previous operation for painful heel were excluded from this study (Table 1).

The study included 20 cases in 12 patients; 8 patients had bilateral involvement while 4 were unilateral. There were 10 women and 2 men. The average age was 43.6 (range, 30-52) years. Fifteen cases had a calcaneus bone spur while no spur was detected in the last 5 cases. None of our patients were diabetic, alcoholics, or smokers. According to activities of the patients, they were as follows: 2 were sedentary (those who work at a desk job and are sedentary at home, with light or no exercise), 2 were lightly active (those who had a desk job but exercised moderately and who stood a lot at work but did not walk around a lot), 5 were active (those who had an active job and exercised moderately to frequently), and 3 were very active (those who had a very active job and exercised frequently). The average follow-up period was 12 (range, 9-16) months.

Preoperative Evaluation of the Patients

Full detailed history of patients’ complaints included duration of symptoms and the previous management, the effect of pain on the level of activity, and the time until presentation. Clinical and radiological evaluation with plain x-ray of the heel with lateral views was done in all patients, and their conditions were scored according to the American Orthopaedic Foot & Ankle Society (AOFAS) Ankle-Hindfoot scale (total points, 100; 40 for pain, 50 for function, and 10 for alignment) (Table 2).

Operative Technique

The operative procedure was done under general anesthesia in 9 patients while spinal anesthesia was used in 3 patients. All operative interventions were performed in the supine position with a thigh tourniquet. The procedure started with...
mid-sole release of the plantar fascia and then percutaneous drilling of calcaneus. The first step was to identify the medial edge of the plantar fascia by palpating the tight cord in the medial side of the foot while dorsiflexing the big toe. A small transverse incision (1-2 cm) was made at the middle of the medial side of the foot; the skin edges were reflected to expose the medial edge of the plantar fascia. A MacDonald dissector was passed under the fascia, which was then divided with a fine knife. After the initial cut of the medial edge of the plantar fascia using the knife, a scissor was placed under the fascia after putting the digits in a neutral position to allow for the scissor to be applied over the fascia while the digits were kept dorsiflexed to complete the release of the plantar fascia until the tension resolved. The last operative step before tourniquet removal was excision of the edges of the released plantar fascia to prevent recurrence of symptoms (Figure 1). Then percutaneous drilling of the calcaneus was performed, even in the absence of a heel spur. In cases with no spur, multiple drill holes (at least 3) were made using the 2.7-mm cannulated drill pit inserted from the plantar aspect of the sole. In cases with a large bone spur, a guide wire was inserted percutaneously into the plantar aspect of the heel at the site of the spur under image intensifier control and after taking multiple views by c-arm to ensure the position of the guide wire, a cannulated 4 mm drill was then applied over the guide wire (Figure 2), and finally, a well-padded bandage was applied.

Postoperative Regimen

Patients were allowed early partial weightbearing on the operated foot as tolerated by pain with a protective soft heel cup. The stitches were removed after 2 to 3 weeks according to healing capacity. Full weightbearing was encouraged once stitches were removed and pain was tolerated with the aid of soft heel cups. Patients were evaluated with the AOFAS Ankle-Hindfoot scale, and the results were recorded for comparison mainly at 4 stages: 3, 6, and 9 months and at final follow-up. All the patients were questioned about the use of external support, footwear requirements, duration of rehabilitation, and their satisfaction. Patients were classified according to their satisfaction into (a) completely satisfied, (b) some reservations, (c) important reservations, and (d) dissatisfied. Finally, the patients were asked whether they would undergo the same procedure again or would recommend it.

Statistical Analysis

Statistical analysis was performed using SPSS version 19.0 (SPSS, Inc, an IBM Company, Chicago, IL). Statistical analysis was done using a 2-tailed Student t test, and \( P < .05 \) was considered statistically significant.

Results

The mean preoperative AOFAS was 50.8 ± 7.5 (range, 43-68) and the mean postoperative AOFAS at the last follow-up was
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91.6 ± 7 (range, 76-100), indicating a statistically significant ($P < .001$) improvement. Patients needed a mean time for full recovery of 8 ± 3.7 weeks (range, 6-16). Apart from delayed wound healing, which occurred in 2 cases (representing 10% of the studied cases), no surgery-related complications or recurrence of pain were noted.

Regarding patients’ satisfaction after doing the surgery, 9 patients (15 feet) were completely satisfied (5 feet had no calcaneal spur and 10 feet had a calcaneal spur), 2 patients (3 feet, all with calcaneal spur) were satisfied with some reservations, and 1 patient (2 feet with calcaneal spur) was satisfied with important reservations; 10 patients (17 feet) would undergo or recommend the surgery while 2 patients (3 feet) would not undergo or recommend this surgery. All patients with no calcaneal spur were completely satisfied, two-thirds of patients with calcaneal spur were completely satisfied, and the other third were satisfied with reservations.

**Discussion**

The goals of treatment for plantar fasciitis are to relieve inflammation and pain in the heel and allow small tears in the plantar fascia to heal. Through our work, most people who had plantar fasciitis recovered with nonoperative treatment, including resting, icing the painful area, and stretching exercises, especially those who started treatment early and continued it for at least 3 months. Operative treatment was only indicated for persistent cases.

There are many techniques of plantar fasciotomy, including either open or mini-open and endoscopic release. Although the standard open medial plantar fasciotomy has been popular, it leads to larger and more painful scars, requires significantly more dissection, has a longer postoperative recovery period, and can lead to nerve entrapment. The endoscopic plantar fasciotomy is a relatively common procedure and has a high rate of success, but some authors have experienced occasional problems with it. Also, the portals can become painful, and nerve entrapment is also possible. In a retrospective study in 1998, it was found that the open heel spur group had the longest time to return to preoperative activity while the endoscopic group had the quickest return. The greatest reduction in preoperative pain was noted in the open fasciotomy group. We did a mini-open release of the plantar fascia in the mid-sole through a

![Figure 1. Steps of midplantar release.](image)
minimal incision with less dissection, ensuring an easy to perform procedure with less adhesions postoperatively and less operative time. We found it gave less complications and a quick recovery.

The site of the incision is a critical factor to the success of this operative procedure. We believe painful scarring could be avoided with that small transverse incision with little dissection necessary before visualization of the plantar fascia, and there is still enough subcutaneous tissue present at this site to minimize any scarring or thickening. This site of incision is ideal because it is in line with the relaxed skin tension lines and is on a nonweightbearing surface, so scarring is minimized. Also, at that site, the plantar fascia is more prominent, facilitating proper visualization and release.9

There is controversy about the proper extent of the plantar fascia release. Barrett and Day2 advocated complete resection of the plantar fascia, but with continued experience and evaluation of postoperative complications, their final recommendation was releasing only the medial one-third of the plantar fascia. They assumed that when the lateral fibers of the plantar fascia are left intact, the locking mechanism for the calcaneocuboid joint would not be disrupted. Partial release of less than 40% of the fascia was recommended by Cheung et al10 to minimize the effect on arch stability and maintain normal foot biomechanics. Brugh et al8 found that when more than 50% of the plantar fascia was released, lateral column symptoms were more likely to result. When a complete plantar fasciotomy is performed, some degree of support to the foot is lost, but this loss of support is usually temporary until muscles and ligaments adapt and accommodate this loss. During this time, patients can experience lateral column instability, sinus tarsi pain, medial arch pain and fatigue, metatarsalgia, and strain along the lesser tarsus. With continued strain, stress fractures may also arise. All 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.13

If the release of the plantar fascia is not enough, pain may persist or rapidly recur. Also, if the opening of the fibers of the plantar fascia is not maintained after release, these fibers can fibrose and reattach.19 We did complete release of the plantar fascia combined with excising a small

Figure 2. (A-C) Steps of percutaneous drilling under the c-arm.
portion of the plantar fascia to decrease the recurrence and failure rate. Our postoperative protocol following this procedure was immediate weightbearing with limited activities. This would place the plantar fascia under tension and allow the site of the fasciotomy to remain open and avoid reahderence and fibrosis. None of our patients at the last follow-up developed any complication regarding the lateral column stability.

The mid-sole plantar fasciotomy had fewer complications compared with traditional open medial release; however, with a plantar incision, there is the potential of delayed healing, excessive plantar fibrosis, and plantar scarring. In our study, none of the patients developed plantar fibrosis and scarring while delayed healing occurred in 2 cases. Excision of the plantar fascia edges and allowing for weightbearing in the early postoperative period decreased the incidence of these complications.

The combination of percutaneous calcaneal drilling with this mini open procedure decreased the failure and the recurrence rates as some authors recommend removing the spur with drilling of the calcaneus if osseous hypertension plays a role in the pathogenesis of heel pain.

By using this simple and minimally invasive procedure, the level of pain declined, the functional activity improved, and the maximum walking distance increased. Closer review of the postoperative results showed 2 distinct categories of patients. Most patients were very satisfied with their surgery and would recommend it to a family member or friend. Three patients (5 feet) showed some important reservations about the results of their surgery and would not undergo the same procedure again. These patients were all female, were very active and overweight, and had a calcaneal spur.

Many factors affect the results of the operative intervention, including body weight, habits such as smoking and alcohol drinking, presence of systemic disease such as diabetes mellitus, level of physical activity, and the psychology of the patients, which may explain varying outcomes of operative treatment of heel spurs in numerous studies.

Boberg did instep fasciotomy to 37 patients with resistant heel pain. The mean preoperative pain level was 4.65, which became 1.59. Postoperatively, most patients experienced either medial arch or lateral pain. The average time to full recovery with a minimum of pain was 3.4 weeks. Most patients were very satisfied with their surgery and would recommend it. Three patients showed absolutely no improvement. Contompasis reported improvement in 82% of patients who had undergone a fasciotomy and excision of the heel spur and 20% of cases with fasciotomy alone. Mann assumed that the results of operative treatment of calcaneal spurs were 50% to 60% satisfactory, while Snook and Christman reported complete success in 7 patients after a 2- to 7-year follow-up. Ali reported permanent relief in 75% of cases with a plantar fasciotomy and 85% of cases with fasciotomy and excision of the spur.

Limitations of the Study

Further studies are recommended to assess and compare the efficacy of mid-sole release of the plantar fascia alone with calcaneal drilling alone or in combination. A further long-term study is needed to evaluate the long-term results regarding the instability and recurrence.

Conclusion

The results were very satisfactory using this minimally invasive technique as a method for treating resistant heel pain with minimal complications, with special attention to the added value of excising the fascial edges and allowing early weightbearing to decrease the recurrence rate. Percutaneous drilling of the calcaneus combined with mid-sole release of the plantar fascia was a rewarding procedure.

Declaration of Conflicting Interests

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