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Endoscopic Plantar Fasciotomy Through Two Medial Portals for the Treatment of Recalcitrant Plantar Fasciopathy

Mohamed Ebrahim Al-Ashhab, MD [1], Hossam El-Dein A. Elbegawy, MD [1], Hala Ali Abed Hasan, MD [2]

[1]*Associate Professor, Orthopedics and Traumatology Department, Benha Faculty of Medicine, Benha University, Qualubia, Benha, Egypt*
[2]*Lecturer, Public Health Department, Benha Faculty of Medicine, Benha University, Qualubia, Benha, Egypt*

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ABSTRACT

Plantar fasciopathy is a common cause of heel pain. Endoscopic plantar fasciotomy has the advantage of less surgical trauma and rapid recovery. The aim of the present prospective study was to delineate the results of endoscopic plantar fascia release through 2 medial portals. The present study included 2 groups. The first group included 27 feet in 25 patients that had undergone endoscopic plantar fascia release followed up for 19.7 (range 12 to 33) months. The second group, the control group, included 20 feet in 16 patients treated conservatively and followed up for 16.4 (range 12 to 24) months. The results of endoscopic plantar fascia release were superior to the conservative methods. The surgically treated group experienced significantly less pain, activity limitations, and gait abnormality. The presence of a calcaneal spur had no effect on the final postoperative score. In conclusion, endoscopic plantar fascia release through 2 medial portals is an effective procedure for treatment of resistant plantar fasciopathy that fails to respond to conservative management options.

The plantar fascia is a thick tissue band that connects the heel bone (the medial tubercle of the under surface of the calcaneus) to the metatarsophalangeal joints, forming the medial arch of the foot, which supports the foot during walking. Irritation and scarring of the plantar fascia is one of the most common causes of heel pain (1,2).

Plantar fasciopathy accounts for 11% to 15% of all foot disorders in both athletes and sedentary patients (3). Although commonly referred to using incorrect nomenclature as plantar fasciitis, it is degenerative process (i.e., fasciopathy). The etiology of plantar fasciopathy is not clear. It can result from irritation due to overstrain of the fascia, which induces mucoid degeneration (4). The pathologic findings include degenerative tissue changes without inflammatory mediators (5,6).

The diagnosis of plantar fasciopathy is determined by the medical history and physical examination findings. Typically, patients present with heel pain during weightbearing, especially in the early morning and with the first steps after a period of inactivity (7). Patients will usually have tenderness around the site of the plantar aponeurosis. The pain can be reproduced by stretching the diseased plantar aponeurosis by passive hyperextension of the metatarsophalangeal joints (8). Tightness of the Achilles tendon with dorsiflexion of the ankle limited by ≥5° will be found in almost 80% of patients (9). Planter fasciopathy should be differentiated from other conditions that present with heel pain such as fat pad atrophy, heel contusion, tibialis posterior tendonitis, tarsal tunnel syndrome, and entrapment neuropathies of the first branch of the lateral plantar nerve (10,11). One of the reference diagnostic tools is ultrasonography. Thickening of the plantar fascia insertion of >5 mm is diagnostic (12).

Most patients with plantar fasciopathy pain can be successfully treated with conservative methods, including pain medications, local steroid injections, plasma-rich protein injections, orthotic devices, plantar fascia stretching exercises, and shockwave therapy. However, for the 10% to 15% of patients who do not obtain relief from conservative care for ≥6 months and experience intractable pain, traditional surgical treatment has offered less than ideal results, with the potential complications outweighing the surgical gains (13).

Endoscopic plantar fasciotomy is a relatively new procedure developed by Barrett and Day (14). The procedure involves an endoscopic approach to the heel, allowing a plantar aponeurosis release to be performed with delicate instruments, minimal dissection, and immediate weightbearing (14,15).

The purpose of the present study was to report the efficacy of this minimally invasive procedure for treating resistant plantar fasciopathy through 2 medial incisions. The local ethical committee approved the study, and the patients were informed about the publication.

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Address correspondence to: Mohamed Ebrahim Al-Ashhab, MD, Orthopedics and Traumatology Department, Benha University Hospital, Koliat elteb Street, Qualubia, Benha, Egypt 1333232.
E-mail address: alashhab3@yahoo.com (M.E. Al-Ashhab).

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Table 1
Patient demographics

Demographic	Group 1 (n = 27 feet in 25 patients)	Group 2 (n = 20 feet in 16 patients)
Age (y)	43 to 61	43 to 64
Sex (n)		
Female	20 (80%)	11 (68.75%)
Male	5 (20%)	5 (31.25%)
Site (n)		
Right	14 (51.85%)	12 (60%)
Left	13 (48.15%)	8 (40%)
Bilateral (n)		
Female	2 (8%)	3 (18.75%)
Male	0	1 (6.25%)
Follow-up period (mo)	12 to 33	12 to 24
Calcaneal spur (n)	20 (74.1%)	20 (100%)

Patients and Methods

The present study was an interventional prospective follow-up study. From January 2014 to July 2015, 47 feet in 41 patients diagnosed clinically with chronic plantar fasciopathy (not responding to conservative treatment for ≥6 months) were included in the present study. All operations were performed by 1 surgeon (H.E.-D.A.E.). The patients were divided into 2 groups. The first group included 27 feet in 25 patients (20 females and 5 males). Two female patients required bilateral treatment. The average age was 51 ± 5.6 (range 43 to 61) years. These patients underwent endoscopic plantar fascia release. The second group was the control group and received conservative treatment. The second group included 20 feet in 16 patients (11 females and 5 males). Four patients had bilateral plantar fasciopathy (3 females and 1 male). The average age was 53 ± 5.8 (range 43 to 64) years. Chronic plantar fasciopathy had been diagnosed clinically in the patients in the second group, and these patients had refused to undergo surgery after failure of conservative treatment. The patients in the second group continued the conservative treatment methods for a minimum of 1 year. Conservative treatment included nonsteroidal antiinflammatory drugs, orthotics, shoe modification, a single local injection, and stretching exercises for the plantar fascia and Achilles tendon. The American Orthopaedics Foot and Ankle Society (AOFAS) scale score was used in the present study. All the patients included in the present study were followed up (Table 1).

The inclusion criterion was nontraumatic onset of plantar pain over the medial aspect of the hindfoot that had been resistant to conservative treatment methods for >6 months. The exclusion criteria were the presence of systemic disease, neuromuscular disorders, and/or anatomic deformities and previous surgery of the affected foot and ankle.

Surgical Technique

Spinal anesthesia was used in all cases. The patient was placed supine, with the operated leg in an externally rotated position. A preoperative antibiotic was administered before tourniquet inflation. Sterilization and draping were performed in the usual manner. Two portals were created through the skin in the medial aspect of the foot in a tangential line from the medial malleolus. The first portal was created through a line tangential to the anterior border of the medial malleolus, and this portal was used for visualization. The second portal was created through a line tangential to the posterior border of the medial malleolus, and this portal was used for instrumentation. The 2 portals were created using the same method with the skin incision created using a no. 11 blade. Next, blunt dissection was performed using an arthroscopic trocar.

A 30° lens was inserted with an irrigation set into the first portal. It has been our experience that an endoscope diameter of 2.5 to 4 mm achieves the best results. An endoscope diameter >4 mm will not allow for proper angulation within the cannula, which is required to maneuver around possible fat obstacles. An endoscope <2.5 mm might not allow proper visualization of the plantar fascia. The motorized shaver was inserted into the second portal, and the undersurface of the plantar aponeurosis was cleaned with the shaver. Next, the basket was inserted through the second portal, and the medial two thirds of the aponeurosis were cut. The 2 portals were closed after deflation of the tourniquet, and a crepe bandage was applied (Figs. 1–5).

Postoperative Regimen

The patients were discharged from the hospital on the same day as the surgery with weightbearing allowed. Walking places the plantar fascia under tension and allows the site of the plantar fasciotomy to remain open, avoiding the development of adherence and fibrosis of the operated site. Medications in the form of oral nonsteroidal antiinflammatory drugs and antibiotics were used for 4 days. The sutures were removed after 2 weeks. Patient follow-up examinations were performed every 2 weeks for the first 2 months and then every month for 3 months. The evaluation score was documented at the last follow-up visit.

Fig. 1. Photograph showing the 2 medial portals.

Statistical Analysis

The collected data were tabulated and analyzed using SPSS, version 20, software (IBM Corp., Armonk, NY). The data were tested for normality, and normal quantitative data are expressed as the mean ± standard deviation. Nonnormally distributed data are expressed as the median, range, and interquartile range. Categorical data are presented as the number and percentage. An independent *t* test was used as the test of significance for parametric data. For nonnormally distributed data, the Mann-Whitney *U* and Wilcoxon ranked tests were used to test the significance between the dependent and independent groups, respectively. The χ^2 was used to test for significance for the categorical variables. The accepted level of statistical significance in the present study was 0.05 ($p \leq .05$).

Results

The present prospective study included 2 patient groups (Table 2). The first group included patients in whom conservative treatment of chronic plantar fasciopathy (≥6 months) had failed and who had undergone surgery. The second group included patients in whom

Fig. 2. Photograph showing 1 portal for the endoscope and 1 portal for the instrumentation.

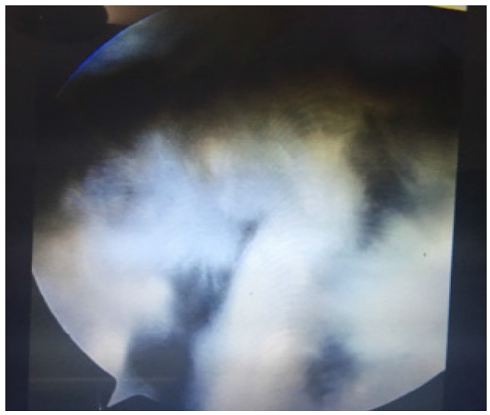

Fig. 3. Intraoperative appearance of the plantar fascia.

conservative treatment of chronic plantar fasciopathy had failed but had refused to undergo surgery.

The AOFAS scale score was used in the present study (16). For the first, surgically treated, group, the first AOFAS scale score was the score after failed conservative treatment, and the second AOFAS scale score was that obtained at the last follow-up visit at ≥12 (range 12 to 33) months postoperatively. The control group also had 2 scores. The first AOFAS scale score was the score at the end of the failed conservative treatment, and the second AOFAS scale score was the score obtained at the last follow-up visit after ≥12 (range 12 to 24) months of follow-up.

In group 1, the 27 feet in the 25 patients included in our study were followed up for an average of 19.7 (range 12 to 33) months. The average patient age was 51 ± 5.6 (range 43 to 61) years. Of the 27 feet, 14 were the right foot (52%) and 13 were the left foot (48%). On the preoperative radiographic evaluation, 20 feet had a calcaneal spur, which was never resected. The average interval required to return to normal daily activity was 26 (range 11 to 29) days. The preoperative mean AOFAS scale score was 57 (range 32 to 62) points. At the last follow-up visit, the mean AOFAS scale score was 94.2 (range 84 to 100) points.

Analysis of the subgroup of 20 feet with a calcaneal spur in group 1 of 27 operated feet showed a mean AOFAS scale score of 94 (range 90 to 100) points. The score was not significantly different from that of the patients without a calcaneal bone spur ($p = .43$).

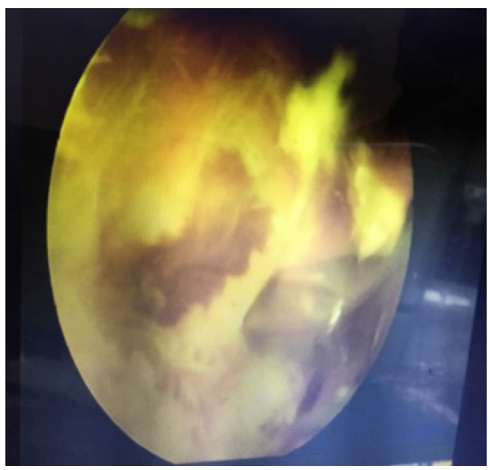

Fig. 4. Endoscopic view showing partial release of the plantar fascia using a basket.

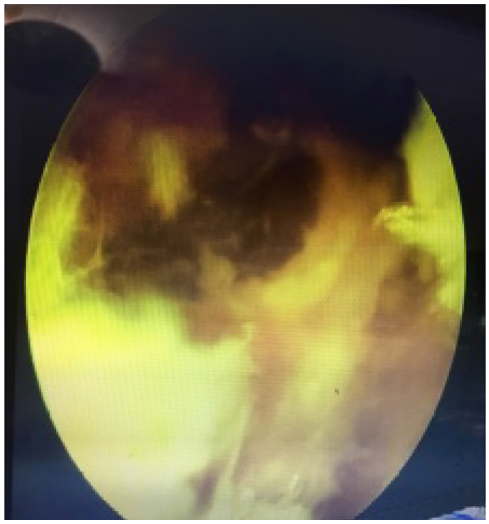

Fig. 5. Endoscopic view showing the remaining lateral part of the fascia.

A statistically significant difference was found between the surgically treated and conservatively treated groups regarding the total and subtotal scores ($p = .000$; Table 3). However, the postoperative scores for sagittal mobility, hindfoot mobility, stability of the ankle, and

Table 2
Comparison between both patient groups before surgery

Variable	Group 1 (Surgery; 27 Feet; 25 Patients)	Group 2 (Conservative; 20 Feet; 16 Patients)	*p* Value
Mean age (y)	51 ± 5.6	53 ± 5.8	.3
Sex			.4
Female	20 (80)	11 (68.8)	
Male	5 (20)	5 (31.2)	
Score			
Pain			.1
Median	20	20	
Range	10		
Activity limitations			1.00
Median	4	20	
Range	0	0	
Maximum walking distance			1.00
Median	2	2	
Interquartile range	2 to 2	2 to 2	
Walking surface			.003*
Median	0	1.5	
Range	0	3	
Gait abnormality			.8
Median	4	4	
Range	0	0	
Sagittal mobility			1.00
Median	8	8	
Interquartile range	8 to 8	8 to 8	
Hindfoot mobility			1.00
Median	6	6	
Interquartile range	6 to 6	6 to 6	
Stability of ankle			1.00
Median	8	8	
Interquartile range	8 to 8	8 to 8	
Alignment			.4
Median	5	5	
Range	0	0	
Overall score			.06
Median	57	57	
Interquartile range	32 to 62	40 to 66	

Data presented as mean ± standard deviation or n (%), unless otherwise stated.
* Statistically significant.

Table 3
Comparison between conservative and surgical groups after treatment

Score	Group 1 (Surgery; n = 27 Feet)	Group 2 (Conservative; n = 20 Feet)	*p* Value
Pain	40 (0)	20 (10)	.000*
Limitation of activity	10 (2)	4 (2)	.000*
Maximum walking distance	5 (1)	2 (1)	.000*
Walking surface	5 (0)	5 (4)	.218
Gait abnormality	8 (8 to 8)	6 (0)	.000*
Sagittal mobility	8 (8 to 8)	8 (8 to 8)	1.00
Hindfoot mobility	6 (6 to 6)	6 (6 to 6)	1.00
Stability of ankle	8 (8 to 8)	8 (8 to 8)	1.00
Alignment	10 (10 to 10)	5 (0)	.000*
Overall	94.2 (84 to 100)	67 (57 to 78)	.000*

Data presented as median (range) or median (interquartile range).
* Statistically significant.

walking surface showed insignificant differences between the 2 groups ($p > .05$).

Statistical analysis also showed that in the first group (Table 4), surgery resulted in improvement in the median pain score, which changed from 20 to 40 points (p =.000) compared with the median pain score of the conservatively treated group, which remained at 20 points (p = .000). Also improvement was found in the other subtotal scores such as activity limitations (median score 4 preoperatively and 10 points postoperatively; p = .000), maximum walking distance (median score 2 preoperatively and 5 points postoperatively; p = .000), walking surface (median score 0 preoperatively and 5 points postoperatively; p = .000), and gait abnormality (median score 4 preoperatively and 8 points postoperatively; p = .000). Alignment had also improved, from a median value of 5 preoperatively to 10 points postoperatively (p =.000). The total score ranged from 32 to 62 points, with a mean of 57 points preoperatively. This range had increased postoperatively to 84 to 100 points, with mean of 94.2 points. This change was statistically significant (p = .000).

All 25 patients (100%) in the surgical group showed marked satisfactory improvement in the total score. However, all 16 patients (100%) in the conservatively treated group showed slight improvement but still unsatisfactory scores (i.e., fair and poor scores).

Regarding the complications observed in the present study, no patient experienced wound dehiscence and/or infection. Neither paresthesia nor numbness developed in any foot. Also, no patients reported limitations in shoe wear.

Table 4
Comparison between surgical group and conservative group before and after surgical intervention

Score	Group 1 (Surgery; 27 Feet)	Group 2 (Conservative; 20 Feet)
Pain		
Before treatment	20 (10)	20 (0)
After treatment	40 (0)	20 (10)
p Value	.000*	.007*
Activity limitations		
Before treatment	4 (0)	4 (4 to 4)
After treatment	10 (2)	4 (2)
p Value	.000*	.03*
Maximum walking distance		
Before treatment	2 (2 to 2)	2 (2 to 2)
After treatment	5 (1)	2 (1)
p Value	.000*	.003*
Walking surface		
Before treatment	0 (0)	1.5 (3)
After treatment	5 (0)	5 (4)
p Value	.000*	.03*
Gait abnormality		
Before treatment	4 (0)	4 (0)
After treatment	8 (8 to 8)	6 (0)
p Value	.000*	.003*
Sagittal mobility		
Before treatment	8 (8 to 8)	8 (8 to 8)
After treatment	8 (8 to 8)	8 (8 to 8)
p Value	1.00	1
Hindfoot mobility		
Before treatment	6 (6 to 6)	6 (6 to 6)
After treatment	6 (6 to 6)	6 (6 to 6)
p Value	1.00	1.00
Stability of ankle		
Before treatment	8 (8 to 8)	8 (8 to 8)
After treatment	8 (8 to 8)	8 (8 to 8)
p Value	1.00	1.00
Alignment		
Before treatment	5 (0)	5 (0)
After treatment	10 (10 to 10)	5 (0)
p Value	.000*	.32
Total		
Before treatment	57 (32 to 62)	57 (40 to 66)
After treatment	92.4 (84 to 100)	67 (57 to 78)
p Value	.000*	.000*

Data presented as median (range) or median (interquartile range).
* Statistically significant.

Discussion

Why some patients do not respond to conservative treatment remains a question. Because the exact cause and exact pathology remain obscured (i.e., fasciopathy), the ideal treatment also remains unclear. Conservative treatment can be effective in some cases. However, in other patients with plantar fasciopathy resistant to conservative treatment, surgery could be indicated. Open plantar fasciotomy is a well-known operation (17,18). Endoscopic plantar fasciotomy is also a well-known procedure that can result in good outcomes, with the advantage of less surgical trauma, less scarring, a shorter hospital stay, and rapid recovery. In our study, the average operative time was 11.6 (range 5 to 17) minutes. Also, all patients were discharged from the hospital the same day of the surgery with full weightbearing allowed.

Several entry portals have been used in previous studies. However, in the present study, we used 2 medial portals, 1 portal for direct visualization of the plantar fascia and 1 portal for instrumentation and release.

When the plantar fascia is dissected, the lateral arch can collapse, with the development of arch instability and the onset of pain to the lateral column of the foot. Although Cheung et al (19) suggested that a partial release (<40%) might minimize the development of such effects on the arch and retain normal foot biomechanics, even partial resection can be destabilizing for the foot. In addition, the ligaments of the lateral column and the lateral plantar fascia band will be strained. Finally, neuropraxia, complex regional pain syndrome, iatrogenic pes planus, calcaneal nerve injuries, hematoma, infection, dehiscence, and postoperative metatarsal or calcaneal stress fractures can also occur (19).

We agree with Nery et al (20), who described the relationship between the presence of a calcaneal spur and the development of plantar fasciopathy. Their study recommended release of the entire plantar fascia and intrinsic musculature from the spur, without excising the spur (20). Excision of the calcaneal spur is technically demanding and can damage the heel fat pad. Our study also demonstrated the absence of a significant difference in the mean postoperative AOFAS scale score between those with and without a calcaneal spur.

The results of endoscopic plantar fascia release have been superior to the results obtained with extracorporeal shockwave therapy (5,13,21). Wang et al (13) studied the long-term results of

extracorporeal shockwave treatment on 168 heels. The shockwave group pain score changed from 25.4 points before treatment to 69.3 points after treatment. The function score changed from 14.1 points before treatment to 29.6 points after treatment. These results were according to the 100-point scoring system for plantar fasciitis. In a study by Othman and Ragab (21), 17 patients had undergone endoscopic release and 20 patients had undergone extracorporeal shockwave therapy. Of the endoscopic release group, 82% were completely satisfied. However, in the shockwave group, 75% of patients were completely satisfied and 25% were satisfied with reservations or unsatisfied (21).

Lundeen et al (22), in a retrospective study, analyzed the satisfaction of patients who had undergone endoscopic fasciotomy. A subjective survey was completed and returned by 53 patients (69 feet), and a review of the medical records was performed to determine the final outcome. Of the 53 patients, 43 (81.1%) were satisfied with the endoscopic procedure and 10 (18.9%) were unsatisfied. Urovitz et al (23) reviewed the medical records of 55 patients with a minimum 12-month history of heel pain that had failed to respond to standard nonoperative methods and had undergone endoscopic plantar fascia release. The mean preoperative AOFAS scale score was 66.5 points and the mean postoperative AOFAS scale score was 88.2 points. The main finding of our study was that endoscopic plantar approach is safe and very effective for the management of recalcitrant plantar fasciopathy. Our prospective study has shown excellent results for endoscopic plantar fascia release compared with conservative treatment. The mean total score for patients changed from 57 (range 32 to 62) points preoperatively to 94.2 (range 84 to 100) points at the end of the follow-up period. Also, no complications that could affect the final outcome were recorded.

The limitations of our study were the small sample size, heterogeneous study population, and different outcome measures. The challenge lies in quantifying the subjective data and which questions should be addressed using the various instruments to assess health-related quality of life. In the present study, we favored the widely used AOFAS scale score to compare the data. However, the AOFAS scale score has not been validated and the translation has not been cross-culturally adapted. Future research should focus on performing randomized clinical trials of a large number of patients to compare different combinations and treatment modalities with long-term follow-up durations.

In conclusion, endoscopic plantar fasciotomy through 2 medial portals is an effective and simple procedure for treatment of recalcitrant plantar fasciopathy. We found no significant importance between the presence or absence of calcaneal spur and the postoperative plantar fascia release outcomes.

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