Endoscopic approach for plantar fasciopathy: a long-term retrospective study

Caio Nery • Fernando Raduan • Nacime Mansur •
Daniel Baunfeld • Angelo Del Buono • Nicola Maffulli

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Abstract

Purpose The purpose of this study was to report the long term effectiveness of endoscopic plantar fascia release for recalcitrant plantar fasciopathy.

Materials Twenty-three consecutive patients underwent endoscopically-assisted plantar fascia release for symptomatic plantar fasciopathy unresponsive to nonoperative measures. The clinical diagnosis was supported by imaging (plain radiographs and magnetic resonance imaging [MRI]) and the American Orthopaedic Foot & Ankle Society

(AOFAS) score was administered to all patients. All patients underwent endoscopic plantar fascia release. Postoperatively, patients were assessed at clinical examination and the AOFAS score was administered.

Results Twenty-two (26 feet) of the 23 patients included in our original cohort returned to our clinic at an average final follow-up of 9.6 years. The mean preoperative AOFAS score of 51 (range, 41–63) improved to 89 (range, 41–97) at the last follow-up, with no statistically significant difference between patients with or without calcaneal bone spur ($p=0.43$). At the last appointment, physically active patients reported significantly higher AOFAS scores than sedentary patients ($p=.008$).

Conclusions This endoscopic plantar approach could be a viable alternative to more invasive procedures for management of recalcitrant plantar fasciopathy. Future randomised controlled trials are needed.

C. Nery • F. Raduan • N. Mansur • D. Baunfeld
Department of Orthopaedic Surgery, Federal University of São Paulo, São Paulo, Brazil

C. Nery
e-mail: Caionery@uol.com.br

F. Raduan
e-mail: Fernando@raduan.com.br

N. Mansur
e-mail: Nacime@uol.com.br

D. Baunfeld
e-mail: danielbaumfeld@gmail.com

A. Del Buono
Department of Orthopaedic and Trauma Surgery, Campus Biomedico University of Rome, Via Alvaro del Portillo, Rome, Italy
e-mail: A.delbuono@unicampus.it

N. Maffulli (✉)
Centre for Sports and Exercise Medicine, Barts and The London School of Medicine and Dentistry, Mile End Hospital, 275 Bancroft Road, London E1 4DG England, UK
e-mail: n.maffulli@qmul.ac.uk

N. Maffulli
Department of Musculoskeletal Disorders, University of Salerno, Salerno, Italy

Introduction

Plantar fasciopathy accounts for 11–15 % of all foot disorders in athletes and sedentary patients [1]. Controversial in its a etiology, repetitive trauma over the calcaneal medial tubercle may lead to degenerative painful changes on the origin of the plantar fascia [2]. Usually self-limiting, when symptoms are longstanding, conservative measures including stretching exercises of the plantar fascia and Achilles tendon, physical therapy, iontophoresis, steroidal and non steroidal anti-inflammatory drugs, shoe modifications, night splints and extracorporeal shock wave therapy (ESWT) may be indicated [1, 3]. Remission of the symptoms is complete in most of the cases but, when symptoms persist after more than six months, surgery could be recommended. The classical operation has been the open release of the fascia [3, 4]. Many procedures have been advocated, with controversial findings, different rates of satisfaction, and complications

such as infection, recurrence, wound breakdown, and iatrogenic damage to nerves and vessels [3, 4]. With the advent of less invasive surgery, endoscopic procedures have also been proposed [5–8]. We describe the use of an endoscopic assisted plantar fascia release technique for plantar fasciopathy. The purpose of this investigation was to report the long-term efficacy of this minimally invasive procedure.

Methods

This is a retrospective analysis of prospectively collected clinical data on 22 (26 feet) individuals, ten men and 12 women, who underwent endoscopically-assisted plantar fascia release for management of symptomatic plantar fasciopathy (Table 1). Of the 23 patients who underwent surgery at our institution from 1991 to 2010, one was not reviewed at the last follow-up as he had moved to another city. The remaining 22 patients underwent surgery at an average age of 52 years (range, 27–75 years), after an

average period of 14.8 months from the onset of symptoms (range, 8–21 months).

The main inclusion criterion was non-traumatic onset of plantar pain over the medial aspect of the hind-foot resistant to conservative care. Specifically, patients were unresponsive to rest, plantar fascia and Achilles tendon stretching exercises, anti-inflammatory drugs, shoe modifications, insole orthoses, and physical therapy for a minimum of eight months. Systemic disease, neuromuscular disorders, obesity, anatomical deformities, and previous surgery on the affected foot and ankle were exclusion criteria. All patients were secondary or tertiary referrals from other health care professionals. All procedures described in this investigation were approved by the local ethics committee.

Preoperative assessment

The senior author (C.N.) managed all patients. At preoperative clinical examination, none of the patients was pain free. The AOFAS score was administered preoperatively in

Table 1 Demographic data, follow-up pre and postoperative AOFAS score

Patient	Age (years)	Foot number	Gender	Activities undertaken preoperative	Activities undertaken operative	F/U (years)	AOFAS	
							Pre op	Post op
1	55	2	M	Not active	Not active	19	61	97
2	44	3	M	Soccer	Soccer	18	41	97
3	57	4	F	Not active	Not active	17	41	84
4	56	5	F	Walking	Walking	14	61	95
5	38	6	F	Not active	Not active	14	41	82
6	56	7	M	Running	Running	14	39	97
6	56	8	M	Running	Running	14	39	97
7	61	9	F	Walking	Walking	12	61	94
7	61	10	F	Walking	Walking	12	61	94
8	46	11	F	Running	Running	12	41	97
8	46	12	F	Running	Running	12	41	97
9	52	13	M	Not active	Not active	10	41	41
10	68	14	F	Not active	Not active	10	41	84
11	41	15	F	Running	Running	9	41	97
12	75	16	F	Not active	Not active	9	41	84
13	69	17	F	Not active	Not active	8	63	94
14	46	18	F	Running	Running	6	41	97
15	56	19	M	Soccer	Soccer	5	41	84
16	43	20	M	Soccer	Soccer	4	61	97
17	42	21	M	Running	Running	4	61	97
18	27	22	M	Running	Running	2	41	84
19	54	23	M	Soccer	Soccer	2	63	94
20	70	24	F	Not active	Not active	2	63	63
21	52	25	M	Running	Running	2	41	97
22	28	26	F	Running	Running	2	41	80
Mean	52					9.6	49	89

AOFAS American Orthopaedic Foot & Ankle Society, M male, F female, F/U follow-up

19 patients; three years after they had been operated upon, the score was retrospectively calculated according to data in charts in three patients. Twenty-two patients reported pain over the medial plantar aspect of the hindfoot; of these patients, two had pain over the plantar medial aspect of the mid-foot and two on the lateral aspect of the ankle. Radiographs (plain lateral weight bearing foot radiographs) were performed in all patients, showing a medial calcaneal spur located under the plantar facet in 12 feet (46 %). Magnetic resonance imaging (MRI) was used to assess concomitant pathologies of the plantar fascia and exclude stress fractures of the calcaneum in all patients.

Operative technique

All patients were operated upon by a single fully trained orthopaedic surgeon (C.N.), under spinal anaesthesia and sedation, using a standard setup. With the patient supine and the leg in external rotation, a calf or thigh tourniquet was inflated to 300 mm Hg after exsanguination of the limb. The tip of medial malleolus was identified and a line was drawn distally to the plantar aspect of the foot. The medial portal was made at this point (Fig. 1), using a periosteal elevator to identify the medial border of the plantar fascia. Introduced transversely, from medial to lateral, the instrument is placed immediately adjacent to the dorsal aspect of the plantar fascia, and palpated laterally. A fenestrated cannula (Instratek incorporated, Houston, TX) with a blunt trochar was introduced through this portal, through the channel formed by the periosteal elevator, and exposed laterally (Fig. 2). The cannula's slotted face was positioned distally, toward to the plantar fascia. A 4.0-mm, 30°-angled arthroscope was introduced from medial to lateral to visualise the plantar fascia. The cannula has two marks, which correspond to the medial border and the transition point between the middle and lateral third of the plantar fascia. Then, a hook blade (Instratek Incorporated, Houston, TX) was introduced through the lateral portal to release the fascia (Fig. 3) from the first to the second mark, in a retrograde

Fig. 1 Medial portal performed in alignment to the medial malleolus

Fig. 2 Fenestrated trochar cannula introduced through the medial portal

fashion, under direct vision. The release can be palpated during the procedure. Both portals were sutured and compression dressings applied without any immobilisation.

Postoperative rehabilitation

Progressive weight bearing, as tolerated, physical therapy and stretching exercises were allowed the day after surgery. Dressings were changed at one week and stitches removed at two weeks. Non impact exercises (stationary bike, swimming, deep running, transport and elliptic machine) were allowed at this point. Running was started at six weeks and contact sports at eight weeks. Patients were assessed at six-month intervals for two years and discharged at that stage.

Follow-up

When the patients were discharged, they were informed about the purpose of the study that they would have been examined in the future. All patients were contacted by telephone or via mail. Patients were assessed at an average of 9.6 years (standard deviation [SD], 2.31 years; range, 2–19 years) from the operation. Conventional lateral weight bearing foot radiographs were performed in all patients. The American Orthopaedic Foot & Ankle Society (AOFAS) score was administered to assess the functional status.

Fig. 3 Representation of a 4.0 arthroscope (medially) and the hook blade (laterally)

Postoperative AOFAS scores were considered as excellent (90–100), good (80–90), fair (70–80) and poor (less than 70) [9]. At the last appointment, patients were asked about their activity level and whether they were satisfied with their condition. Clinical examination and functional evaluation were performed by a single trained examiner (F.R.) not involved in the surgery.

Statistics

After assessment of the data using the Kolmogorov-Smirnov test, the Wilcoxon test was used to compare pre- and post-operative AOFAS score and the difference between them. Independent-sample *t* tests were used to compare the clinical scores between sedentary and physically active patients. We considered $P < 0.05$ as significant. Analysis was performed by a statistician using SPSS software, version 13.0 (SPSS, Chicago, IL).

Results

Twenty-two (26 feet) of the 23 patients included in our original cohort were followed up at an average of 9.6 years. Thirteen patients were athletes; nine were not physically active. The right foot was involved in 16 (61.5 %) cases, the left in 10 (38.5 %). On preoperative radiographic evaluation, 14 of 26 (53.8 %) feet had a calcaneal spur, which was never resected (Table 2). The average time to return to activity was 26 days (range, 11–29). The mean AOFAS score preoperatively was 51 (range, 41–63). At the last follow-up, the mean AOFAS score was 89 (range, 41–97).

Table 2 Comparative post op data regarding physical activity, side, spur and symptoms duration

Variable	AOFAS pre	AOFAS post	SD	Min	Max	N	P
Active							0.010
Yes	47	93	5.51	80	97	17	
No	50	80	18.14	41	97	9	
Side							0.051
Right	44	92	6.48	82	97	10	
Left	51	87	15.45	41	97	16	
Spur							0.434
No	46	89	10.72	63	97	12	
Yes	51	89	14.86	41	97	14	
Period with symptoms							0.717
Up to one year	49	91	9.92	63	97	13	
More than one year	48	88	15.54	41	97	13	

AOFAS American Orthopaedic Foot & Ankle Society, SD standard deviation

The analysis of the subgroup of 14 patients with calcaneal spur showed an average AOFAS score of 89 at an average follow-up of 11.5 years, not significantly different from patients without calcaneal bone spur ($p=0.43$). Postoperatively, the AOFAS score was graded excellent in 17 feet (65.3 %), good in seven (26.9 %), and poor in two (7.8 %). Two patients (7.8 %) reported AOFAS scores of 41 and 63, respectively; one underwent open release of the Baxter branch four months from the first operation and one underwent partial medial fascectomy for plantar fibromatosis which was diagnosed two months later. When asked about their condition, only these two patients answered that they were not satisfied. The symptoms completely disappeared after the second operation. At the last appointment, physically active patients reported a mean AOFAS score of 95 (range 80–97), significantly higher ($p=0.008$) than the average value of 81 (range 41–97) observed in sedentary patients.

Concerning complications, a stress fracture of the third metatarsal occurred in one patient. This patient reported an AOFAS score of 97 after conservative management. No patients experienced wound dehiscence and/or infection, paresthesia, or numbness in their foot. No limitation in shoe wear was reported.

Discussion

The main finding of our study is that this endoscopic plantar approach is safe and very effective for the management of recalcitrant plantar fasciopathy. In fact, at almost ten-year follow-up, the mean AOFAS score was significantly improved compared to baseline, and more than 90 % of the patients were scored as good and excellent. We propose this minimally invasive approach to reduce common complications of more invasive surgery. Even though traditional plantar fascia release, resection or debridement of the affected portion of the fascia provide good results, postoperative recovery may be prolonged, and some complications may occur. When the plantar fascia is dissected, the lateral arch may collapse, with development of arch instability, and onset of pain to the lateral column of the foot [1]. Even though Cheung et al. suggested that a partial release (less than 40 %) may minimise such effects on the arch and keep the foot biomechanics normal [10], even a partial resection may be destabilising for the foot; in fact, the ligaments of the lateral column and the lateral plantar fascia band are nevertheless strained [11]. In addition, neuropraxia [12], complex regional pain syndrome [3], iatrogenic pes planus, calcaneal nerve injuries, haematoma, infection, dehiscence, and postoperative metatarsal or calcaneal stress fractures may also occur [4, 13–15]. Conversely, percutaneous plantar approaches are simple, cost-effective, and good to excellent in 83 % to 89 % of patients [16]. Lane et al. reported

that percutaneous plantar transverse surgery was successful in 96 % of patients at an average follow-up of 21 months, with minimal patient morbidity, quick recovery and return to normal activities, and no risk of nerve injury [17]. White [18] described the release of the entire plantar fascia and intrinsic musculature from the spur, without excising it. Minimally invasive plantar transverse incision provides 96 % success rate, higher than that observed following traditional open release [17]. Specifically, radiofrequency microtenotomy is simple, and improves pain and functional scores, without cutting the plantar fascia [19]. The unique negative condition could be the damage to adjacent tissues [19, 20].

Weil et al. [21] described the bipolar radiofrequency microfasciotomy. This significantly improves AOFAS scores from an average preoperative value of 57.4 to a postoperative of 88.5, at a minimum of 12 months, with no notable complications. In this way, the plantar fascia is spared, and a more homeostatic environment is achieved, stimulating healing and remodelling of the fascia.

Cryosurgery improves pain, has low cost and is safe [22]. However, the cycle of freezing, thawing, and freezing may damage axons and cellular elements, altering the pain pathway [22, 23]. It has been recently reported that platelet rich plasma (PRP) injections are safe and may reduce pain in patients with this condition [24]. However, the fact that it was a preliminary short-term study does not allow us to draw any definitive conclusion about the efficacy of such management, and some concerns are justified about the injection interval time, methodology of preparation, and dosage [25].

We report the long-term outcomes in 22 patients undergoing endoscopic release of the plantar fascia and debridement of the surrounding soft tissues. The results of endoscopic plantar fascia release vary from 81.1 % to 97 % [4–6, 26–29]. Blanco et al. described an endoscopic assisted plantar fasciotomy [7], with debridement of reactive periosteum of the calcaneus and resection of the calcaneal spur. We did not remove the spur because it is technically demanding and may damage the heel fat pad. In our study, at almost ten years from surgery, the mean AOFAS score was 89 (range, 41–97), and 24 of 26 feet (92.2 %) were scored as good and excellent. The average return to activity of 26 days was not different from that already published. When comparing endoscopic and traditional open fasciotomy with heel spur resection [4], the time to return to work was 29 days after endoscopic release and 84 days after open surgery [4]. We reported one complication. It was a stress fracture of the third metatarsal, which completely resolved after conservative management. The reason why active patients reported significantly higher scores than those who were sedentary could be that some stretching exercises of the plantar fascia and intrinsic muscle structures would prevent formation of adhesions, and be beneficial in the long term.

Our investigation is flawed by a number of methodological shortcomings. Specifically, this is a retrospective analysis. The AOFAS score was used as outcome measure. Even though it has been recently shown not to be valid and reliable, almost all our patients were satisfied with their results at the final follow-up. The relatively small sample size made statistical analysis of the data difficult, and a control group of patients was absent. Nonetheless, the results of this investigation would prompt future prospective cohort studies and randomised controlled trials to focus on minimally invasive surgery of this condition.

Conclusion

This endoscopic plantar approach could be a viable alternative for management of recalcitrant plantar fasciopathy.

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