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Original Article

Endoscopic plantar fasciotomy versus injection of platelet-rich plasma for resistant plantar fasciopathy

Ahmed Mohamed Ahmed Othman^{a,*}, Islam Hassan Ali Hegazy^b

^a Department of Orthopedic and Trauma Surgery, Faculty of Medicine, El-Minia University, El-Minia 61111, Egypt

^b Department of Orthopedic and Trauma Surgery, Faculty of Medicine, Benha 13111, Egypt

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ABSTRACT

Background: Resistant plantar fasciopathy is a common orthopedic problem.

Aim: Comparing two different methods of treatment.

Methods: Fifty patients with chronic resistant plantar fasciopathy were divided into two groups. The first included 23 patients treated by endoscopic release of plantar fascia (EPF) and the second included 27 patients treated by injection of platelet-rich plasma (PRP).

Results: In the EPF group, the average VAS improved from 8.28 to 2.35. The average AOFAS improved from 65 to 94. In the PRP group, average VAS improved from 8.22 to 2.9 and the average AOFAS improved from 66 to 92.

Conclusion: Both methods gave comparable results at late follow-up.

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1. Introduction

The term 'plantar fasciitis' implies an inflammatory condition by the suffix 'itis'. However, various lines of evidence indicate that this disorder is better classified as 'fasciosis' or 'fasciopathy', as heel pain is associated with degenerative changes in the fascia and atrophy of the abductor minimi muscle.¹

Initial treatment is non-operative and consists of relative rest, physical therapy, stretching, exercises, shoe inserts/orthotics, night splints, non-steroidal anti-inflammatory drugs, and local corticosteroid injections. Patients not responding to conservative treatment for 4–6 months (between 10% and 20% of all patients) are candidates for more

aggressive treatment such as extracorporeal shock wave therapy (ESWT) and surgery.^{1,2}

Platelet-rich plasma (PRP) is an emerging injection-based treatment for various chronic degenerative soft-tissue diseases. It is postulated to promote native tissue regeneration; however, consistent scientific evidence remains lacking.³

PRP is the plasma fraction of autologous blood which has a platelet concentration above baseline. The normal platelet count in whole blood in a healthy individual is between 1.5 and $4.5 \times 10^5/\mu\text{L}$. To be labeled as PRP, a platelet count of 4–5 times of the baseline should be present in the platelet concentrate.⁴

Surgical treatments for chronic severe plantar fasciitis, including plantar fasciotomy with and without neurolysis of the calcaneal branches of the tibial nerve, have demonstrated

* Corresponding author.

E-mail address: osman682012@yahoo.com (A.M.A. Othman).

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conflicting late clinical results with pain and disability persisting in many patients.^{5,6}

Potential surgical complications include infection, skin slough, nerve injury, and vascular damage. This has led to the adoption of less invasive surgical release techniques such as the endoscopic fasciotomy and bipolar radiofrequency microtenotomy.^{7,8}

Endoscopic plantar fasciotomy (EPF) for the treatment of chronic plantar fasciitis/heel spur syndrome was developed by Barrett and Day.⁹ The procedure involves an endoscopic approach to the heel, allowing a plantar fasciotomy to be performed with delicate instruments, minimal dissection, and immediate weight bearing. EPF provides the patient with decreased postoperative morbidity and excellent relief of pain.

2. Material and methods

The study included 50 patients with unilateral affection by chronic plantar fasciitis. In all cases, conventional conservative treatment consisting of non-steroidal anti-inflammatory drugs, heel cup, orthoses and/or shoe modifications, and local steroid injections had failed. The patients were randomly classified into two groups according to the method of treatment. Each method was simply clarified to the patients and a written consent was taken from every patient before the start of the study.

All patients were examined pre-operatively for local pain, tenderness, shape of the foot as well as the arch of the foot and orientation of the heel for deformities or flat foot.

Radiological examination was done for the affected heels to exclude local heel pathology including subtalar arthritis, local lesions of the calcaneus, etc.

2.1. Inclusion criteria

Cases with chronic plantar fasciitis after a minimum period of 6 months with no response to traditional methods of conservative treatment including NSAIDs, physical therapy, stretching exercise, and local injection of corticosteroids.

2.2. Exclusion criteria

Active bilateral affection, collagen diseases, cases of old fractures of the calcaneus, and previous surgical interference.

2.2.1. The first group was treated by EPF

This group included 23 patients. The age of the patients ranged between 22 and 51 years with an average of 39.14 years, the pre-operative VAS ranged between 7 and 9 with an average of 8.28, the pre-operative AOFAS ranged between 57 and 78 with an average of 65 and the pre-treatment duration of symptoms ranged between 6 and 23 months with an average of 10.96 months (Fig. 1 and Table 1).

2.3. Technique of EPF

Under general anesthesia and supine position and with a tourniquet applied to the upper thigh, the procedure was performed in all patients using medial and lateral portals. The

medial portal was placed 2 cm above the distal heel skin and about 1 cm behind the posterior border of the medial malleolus. A small horizontal incision and blunt dissection of subcutaneous tissue medial to the plantar fascia were done. A path was created using a curved elevator just distal to the plantar fascia from medial to lateral border. A slotted arthroscopic cannula was introduced in this plane until impinging on the lateral skin of the heel to create the lateral portal through small incision. The arthroscope was then introduced from medial portal for visualization of plantar fascia. Using a hook knife through the lateral portal and the slotted cannula, divided the medial half of the plantar fascia from medial to lateral direction under direct vision.

2.3.1. The second group was treated by PRP

This group included 27 patients. The age of the patients ranged between 25 years and 49 years with an average of 36.04 years, the pre-operative VAS ranged between 7 and 9 with an average of 8.22, the pre-operative AOFAS ranged between 57 and 75 with an average of 66 and the pre-treatment duration of symptoms ranged between 6 and 34 months with an average of 11.59 months.

2.4. Technique of PRP injection

2.4.1. Platelets-rich plasma preparation

Blood is withdrawn from the patient (about 50 ml) into a 60-ml syringe that contained 5 ml sodium citrate. Then the blood is centrifuged for approximately 15 min (3000 rounds per minute) using desktop centrifuge. The blood is then separated into platelets poor plasma and platelets-rich plasma. The platelets poor plasma is then extracted and discarded. After one more shaking procedure, the PRP is withdrawn. The resulting platelets concentrate contains approximately a 6–8 times concentration of platelets compared to baseline whole blood.

2.4.2. Injection technique

The procedure is done on an out-patient basis and under complete aseptic condition. Then, 5 cc platelets concentrate is injected using a 22 needle into the most tender area of plantar fascia using a peppering technique (a single skin portal and 4 or 5 penetrations to fascia).

2.4.3. Post-injection protocol

Patients are discharged to home with instruction to limit their activities for 48 h and use acetaminophen for pain control. After 2 days, patients are sent to the physiotherapist to start stretching exercises for 2 weeks and strengthening exercises for additional 2 weeks. At 4 weeks post-injection, the patients are allowed to start normal recreational activities.

3. Results

The results were evaluated using the VAS and the AOFAS and the criteria of Roles and Maudsley score.¹⁰ Patients were reviewed at 6, 12, and 24 weeks post-treatment and at 3 months interval until the end of the study.

Fig. 1 – Pre-treatment data.

In the first group (treated by EPF): the follow-up period ranged between 6 and 42 months with an average of 18.25 months. The VAS ranged between 1 and 4 with an average of 2.35 and the AFOAS ranged between 78 and 97 with an average of 94.

As regards patient satisfaction after treatment, eighteen cases (78.26%) were satisfied, 3 patients (13.04%) were satisfied with reservation, and 2 patients (8.69%) were not satisfied.

According to Roles and Maudsley score,¹⁰ 12 were excellent (52.17%), 6 good (26.08%), 3 acceptable (13.04%), and 2 cases were poor (8.69%).

In the second group (PRP), the follow-up period ranged between 6 and 40 months with an average of 17.45 months.

The VAS ranged between 1 and 4 with an average of 2.9 and the AFOAS ranged between 78 and 95 with an average of 92.

Concerning patient satisfaction in this group, twenty cases (74.07%) were satisfied, 4 patients (14.81%) were satisfied with reservation, and 3 patients (11.11%) were not satisfied.

According to Roles and Maudsley score, 13 were excellent (48.14%), 7 good (25.92%), 4 acceptable (14.81%), and 3 cases were poor (11.11%) results (Figs. 2 and 3; Tables 2 and 3).

3.1. Complications of treatment

3.1.1. Endoscopic fasciotomy group

One case with persistent drainage from the wound, which resolved after 3 weeks of repeated dressing, and one case with numbness and paresthesia along the distribution of lateral plantar nerve resolved after 4 weeks without any residue.

3.1.2. PRP group

No reported complications apart from post-injection pain in a few cases, which was treated by rest and pain killer for a few days.

Furthermore, there were no reported long-term complications such as foot deformities, chronic infections, or changes in the arch of the foot at late follow-up.

Table 1 – Pre-treatment data.		
	EPF	PRP
Number	23	27
Average age	39.14	36.04
Pre-treatment duration	10.96	11.59
VAS	8.28	8.22
AOFAS	65	66

Fig. 2 – Results according to Roles and Maudsley score.

Table 2 – Results according to Roles and Maudsley score.

	EPF	PRP
Excellent	52.17%	48.14%
Good	26.08%	25.92%
Acceptable	13.04%	14.81%
Poor	8.69%	11.11%

3.2. Statistical analysis

The pre-treatment data as well as the results were collected and presented as mean (SD), median, and count as appropriate. Means were analyzed using unpaired Student's t-test for differing variances, medians by Mann-Whitney U tests, and counts or proportions by Fisher-Freeman-Halton generalized extraction tests.

Concerning the pre-treatment data of both groups, there was no statistically significant difference regarding the age ($P = 0.78754$), sex ($P = 0.89587$), pre-treatment duration of symptoms ($P = 0.86754$), VAS ($P = 0.79853$), or the AOFAS ($P = 0.87653$).

The changes in the post-operative results were evaluated using Wilcoxon Matched Pairs test. The change in the post-treatment VAS was 5.93 for the EPF group ($P = 0.001$) and 5.32 in the PRP group ($P = 0.0001$) and this result was significant.

As regards the change in the average post-operative AOFAS, it was 29 for the EPF group ($P = 0.001$) and 26 in the PRP group ($P = 0.0001$).

When comparing the difference in the post-operative results of both groups, there was no significant difference between the 2 groups either in the VAS ($P = 0.67547$) or AOFAS ($P = 0.79853$).

4. Discussion

Whilst most cases of plantar fasciitis can be settled with existing conservative treatment, a few intractable cases can be difficult to resolve. New biologic treatments have been proposed for a variety of soft tissue problems.¹¹

Table 3 – Results of the whole study.

	EPF	PRP
Follow up	18.25	17.45
VAS	2.35	2.9
AOFAS	94	92
Satisfied	78.26%	74.07%
Satisfied with reservation	13.04%	14.81%
Not Satisfied	8.69%	11.11%

Recent literature shows positive effects for the treatment of tendinosis with autologous platelet injections.¹²

Early success in using PRP to treat chronic refractory tendinopathy has led to consideration for its use in the management of recalcitrant cases of plantar fasciitis.¹³⁻¹⁵

Lopez-Gavito et al.¹⁶ treated a small mixed group of patients in an uncontrolled study with a minimum of 12 months of severe chronic plantar fasciitis and/or Achilles tendinosis and noted American Orthopedic Foot and Ankle Society (AOFAS) hindfoot score improvement from 39 to 97 by month 4 after PRP treatment. Visual analog scale (VAS) scores for pain before treatment dropped from 9 down to 2 after injection.

Akashin et al.¹⁷ completed a prospective nonrandomized comparison of PRP and corticosteroid injection for plantar fasciitis. Sixty patients who had failed 3 months of conservative care were treated in 2 consecutive groups of 30 each with either 40 mg methylprednisolone or 3 ml of PRP and were followed up for 6 months. The mean VAS scores dropped from 6.2 to 3.2 in the steroid group and 7.33 to 3.93 in the PRP group at 6-month follow-up. They concluded that while both treatments appeared effective, PRP injection appeared to be the safer of the two.

Martinelli et al.¹⁸ treated fourteen patients with chronic plantar fasciitis receiving three injections of PRP into the plantar fascia. According to criteria of the Roles and Maudsley score, at 12 months of follow-up, results were rated as excellent in nine (64.3%), good in two (14.3%), acceptable in two (14.3%), and poor in one (7.1%).

Fig. 3 – Results of the whole study.

Monto¹⁹, in a prospective, blinded and randomized comparison study of PRP and corticosteroid injection for severe chronic cases of plantar fasciitis included 40 patients who had failed 4 months of conservative care. One group received an ultrasound-guided injection of 40 mg depomedrol and the second group received an ultrasound-guided injection of 3 ml PRP. The average pretreatment AOFAS score in the steroid group was 52 and improved to 81 at 3 months after treatment. The average pretreatment AOFAS score in the PRP group was 37 and improved to 95 at 3 months after treatment. However, the steroid group scores degraded with a sharp drop in the AOFAS rating to 74 at 6 months and 58 at 12 months after treatment. In contrast, the PRP group scores remained high with AOFAS scores of 94 at 6 and 12 months after treatment.

Franceschi et al.²⁰ performed a systematic review on the effects of PRP in PF. They only included prospectively designed studies in humans. Eight articles met the inclusion criteria and three of them were randomized. All studies yielded a significantly greater improvement in symptoms between baseline and last follow-up assessment. None of the papers recorded major complications.

In 2012, the corresponding author shared in a study included 25 patients with chronic plantar fasciitis with a mean age of 44 years who were treated by PRP injection, the average VAS changed from 9.1 to 1.6. Twenty-two patients (88%) were completely satisfied, two patients (8%) were satisfied with reservations, and one patient (4%) was unsatisfied.

In the current study, PRP method continued the success story. The results of PRP injection were very encouraging and pushing to continue using the same technique in the future.

Various surgical treatment procedures for plantar fasciitis, such as open surgery, percutaneous release, and endoscopic surgery, exist. Skin trouble, nerve disturbance, infection, and persistent pain associated with prolonged recovery time are complications of open surgery. Endoscopic partial plantar fascia release offers the surgeon clear visualization of the anatomy at the surgical site.²¹

Plantar fasciotomy is offered to patients with recalcitrant plantar fasciitis. Few studies have characterized the functional outcomes over time for the endoscopic approach compared with the open approach.²²

Lundeen et al.²³ in a retrospective study analyzes satisfaction of patients who had undergone an isolated EPF. A subjective survey was completed and returned by 53 patients (a total of 69 feet), and a chart review was performed to determine final outcome. Postoperative follow-up averaged 7.2 months (range, 4–42 months). Postoperative pain levels were scored on a 7-point scale at 1 week, 1 month, and 6 months. Forty-three patients (81.1%) were satisfied with the EPF procedure and 10 patients (18.9%) were unsatisfied.

Marafko²⁴ treated 83 EPF that were performed on 74 patients (age: 47 ± 11 years). Pain was significantly lower at every assessment point as compared to preoperative values ($P < 0.01$). The average period of time during which patients became pain-free (i.e. VAS = 0) was 9.6 weeks. Most patients were overweight as indicated by the BMI = 32.8 ± 5.9 kg/m². All but three operations proved to be successful as indicated by disappearance of pain. Two patients had reoperation of whom the BMI > 30 kg/m².

Urovitz et al.⁸ reviewed the charts of 55 patients with a minimum 12-month history of heel pain that failed to respond to standard non-operative methods and had undergone endoscopic plantar fascia release. The mean follow-up was 18 months. The mean preoperative AOFAS score was 66.5; the mean postoperative AOFAS score was 88.2. The mean preoperative pain score was 8.6; the mean postoperative pain score was 3.1. Complications were minimal (2 superficial wound infections). Overall, results were favorable in over 80% of patients.

Nery et al.²⁵ treated twenty-three consecutive patients who underwent endoscopically assisted plantar fascia release for symptomatic plantar fasciopathy unresponsive to non-operative measures. Twenty-two (26 feet) of the 23 patients included in their original cohort returned 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 ($P = 0.43$).

Chou et al.²² analyzed the prospectively collected data of all patients undergoing plantar fasciotomy in a total of 42 feet of 38 patients. Patients undergoing endoscopic surgery had significantly greater American Orthopedic Foot and Ankle Society Ankle-Hindfoot and SF-36 Health Survey scores and lower pain scores at the 3-month period. Compared with the open approach, the patients who had undergone EPF experienced significantly greater improvements in the subjective and objective functional outcomes, with less pain and greater satisfaction, with equivalent long-term outcomes.

The senior author published a comparative study in 2010 included 37 patients with chronic plantar fasciitis. Seventeen patients were treated by EPF and twenty cases were treated by ESWT.

In the EPF group, the mean follow-up was 11 months, the average VAS improved from 9.1 to 1.6. Ten patients (58.8%) had no functional limitations post-operatively, and six patients (35.3%) had minimal functional limitations. Only one patient (5.9%) had moderate functional limitation post-operatively. Fourteen patients (82.3%) were completely satisfied, two patients (11.8%) were satisfied with reservations, and one patient (5.9%) was unsatisfied.

In the second group (ESWT), the mean follow-up was 7.6 months using the same VAS; the pain was improved from average of 9 pre-operatively to average of 2.1 post-operatively. Post-procedure, ten patients (50%) had no functional limitations of activities, seven patients (35%) had minimal limitation of functional activities, two patients (10%) had moderate functional limitation, and one patient (5%) had marked limitation of functional activities. Fifteen patients (75%) were completely satisfied with results, three patients (15%) were satisfied with reservations, and two patients (10%) were unsatisfied.

Our results of EPF in both studies match and also match the results of some authors and promising to continue use of the same technique in properly selected cases.

5. Conclusion

Treatment of chronic plantar fasciitis can be achieved by different treatment modalities. When traditional conservative

methods fail one should try new biological methods of treatment. PRP injection is safe and has the potential to reduce pain and symptoms with long-term relief. PRP injection can be considered as a second line of treatment after traditional conservative measures for chronic plantar fasciitis and should be tried before any surgical interference. EPF should be reserved for severe cases not responding to conservative methods of treatment and after the use of PRP.

Conflicts of interest

The authors have none to declare.

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