Management for the Plantar Fasciopathy

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Abstract: Plantar fasciopathy (PF) is a degenerative condition with the preference of pain or discomfort at the base of the foot. This article summarizes the advances of treatments and condenses the cause, diagnosis and prevention of PF, aiming to provide a basis in managing PF. Causes of PF includes insufficient ankle dorsiflexion, increasing age, thickening in plantar fascia, high body mass index (BMI) and long-term weight loading or overexercise. Diagnosis is history and physical examination of a history of pain or discomfort in the heel that had been particularly severe during the first morning steps after rising, with tingling on palpation of the heel. And the performance of thickening of plantar fascia on Ultrasound can be used to confirm. Treatments include physical therapy (PT), extracorporeal shock wave therapy (ESWT), platelet-rich plasma (PRP) and acupuncture. Every treatment has different characteristics and the efficacy varies from person to person.

1 INTRODUCTION

Plantar Fasciopathy (PF) is a degenerative condition that result from biomechanical overuse, including fasciitis (acute inflammatory) and fasciosis (chronic degenerative diseases). PF typically manifests as pain or discomfort in the calcaneus, the base of the foot where the metatarsal fascia inserts and is frequently worst during the first few steps after waking up in the morning (Tan et al., 2024). A third of PF is bilateral, although the majority is unilateral (Tseng et al., 2023). The incidence of PF is 4‰ per year and the lifetime incidence is amost 10%, which indicates that PF occurs in about 10% of the population in their lifetime. The ankle dorsiflexion limitation is the main risk factor (Tseng et al., 2023).

PF brings a negative impact on people's life satisfaction and athletic experience and can even have physical and psychological repercussions. Currently, there has been a substantial increase in the number of publications on PF, which indicates that the emphasis on PF has been increased in recent years.

At present, diagnosis of PF has been relatively clear. Currently PF is generally diagnosed by history and physical examination (Tan et al., 2024). Ultrasound is also an acceptable diagnostic method for PF. As for conservative treatment, physical therapy (PT) and extracorporeal shock wave therapy (ESWT) have emerged as the mainstream treatment methods. Acupuncture and platelet-rich plasma (PRP) have also gained popularity in recent years. And for patients who fail to nonoperative therapy and the pain became chronic, surgery is generally performed. Only conservation treatments are described in this article. PT is a safe, convenient and effective treatment dealing with PF, but its efficacy varies in individuals. ESWT is a noninvasive and highly effective modality with a short course of treatment, while is not suitable for bleeding or infected individuals. PRP is a treatment with good long-term effect, but the cost is high. Acupuncture offers pain relief and improves circulation, but has poor medical compliance. However, none of these treatments are the best. The efficacy depends on age, BMI and the severity. Prevention of occurrence and recurrence of PF is a good way to improve the quality of life for patients. These days, more and more studies have focused on treatment options for PF, but there is a lack of systematic sorting and analysis. This article provided a summary of the disease's cause, diagnosis, therapy, and prevention with the aim of giving most patients a basis in managing their PF.

2 CAUSE OF DISEASE

PF is a degenerative condition and is a collective term for heel pain caused by acute inflammation and chronic degenerative disease in the heel. Causes of PF are multifactorial, including range of ankle

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dorsiflexion, age, plantar fascia thickness, body mass index (BMI) and long-term weight loading or overexercise. Among them, ankle dorsiflexion limitation is the main risk factor (Tseng et al., 2023). The incidence increased significantly between 40 and 60 years of age, and the incidence rates of PF among adults by age were as follows: Between the age of 30 and 40 (22%), 41 and 50 (36%), 51 and 60 (32%), 61 and 70 (2%), and over 70 (8%) (L et al., 2013). The plantar fascia thickness of PF patients was 2.16mm lower in comparison to that of normal individuals (95% CI:1.60~2.71 mm, P<0.001), which became one of the criteria for the diagnosis of PF (X et al., 2021). Individuals who were overweight with BMI>25kg/m² or obese with BMI>30kg/m², were 1.4 times more likely to have PF than others. Occupation-related prolonged weight-loading and overexercise also increases the likelihood of PF, which may be related to the prolonged elevated plantar load. In non-athletic population, factors associated with plantar heel pain also include specific foot such as foot with collapsed arch, and insufficient ankle strength (Sullivan et al., 2020). Moreover, psychological factors encompass depression, nervous, kinesiophobia and catastrophizing are also associated with PF (Mørk et al., 2024).

3 DIAGNOSIS

Consensus statements and guideline for the diagnosis and management of plantar fasciitis in Singapore' pointed out that history and clinical evaluation to diagnose PF is a common method that had reached general consensus (Tan et al., 2024). Common symptoms of PF include plantar heel pain or discomfort, which is exacerbated during the first few steps after waking up or after a period of inactivity. While adequate activity helps lessen pain, excessive activity or weight-bearing tasks will cause it to return. Physical examination is generally characterized by the following two points. First, patient may walk in an abnormal posture to minimize heel pain. Second, palpation of the medial side of the calcaneal triggers tingling (Goff and Crawford, 2011).

It is worth noticing that other causes of heel pain should be ruled out before a diagnosis of PF is made, including calcaneal spur, plantar tendon injuries, and scaphoid fractures. Beside Ultrasound (US) is a reliable way to differentiate, and is a common option in not only diagnosis, but also monitor due to its low prices and convenience. Ultrasound of PF showed thickening and hypoechoic of the plantar fascia, which is one of the criteria for auxiliary diagnosis. Moreover, radiographic imaging and Magnetic resonance imaging (MRI) are valuable ways to view tendon and bone lesions, but they are incompletely necessary when symptoms are clear. MRI shows an increase in plantar fascia and a signal increase on T2-weighted and short tau inversion recovery images.

4 TREATMENT

4.1 Physical Therapy (PT)

PT, a first-line treatment, mainly includes stretching and strengthening. Both can reduce pain and correct gait pattern and show good results. In a randomized controlled trial involving 50 patients, the control group (n=25) received ankle mobilization training, and the intervention group (n=25) received the same combined with gluteal muscle strength training (X et al., 2024). For four weeks, both groups received training twice a week and they were monitored for 3 months following therapy. The American Orthopedic Foot and Ankle Society (AOFAS) and Visual Analogue Pain Score (VAS) were utilized for scoring.

According to the result, the intervention group had lower VAS (1.52 vs 2.68, P<0.01) and higher AOFAS ankle-hindfoot scale (89.64 vs 81.24, P<0.01), from which it can be inferred that ankle mobilization combined with gluteal muscle strength training significantly improved functional results and decreased heel pain in patients with PF.

In another research, which involves 56 patients also shows a positive result (H et al., 2024). In this research, patients were split into two groups at random: an observation group and a control group, each with 28 patients. Both groups received stretching instruction, and kinesio taping was added to the observation group. After the treatment, the outcome in the observation group was manifested by a lower VAS (3.85 vs 3.03, P<0.05), a higher AOFAS (56.35 vs 62.13, P<0.05) and a higher Berg Balance Scale (BBS) (34.22 vs 37.79, P<0.05). It is to say, stretching training plus kinesio taping can reduce pain, improve joint movement, and enhance balance ability in patients with PF.

PT can be combined with other mechanical treatment, encompass night splints, rock shoes, and ankle-foot orthoses. Moreover, PT can also be combined with injection as aids. In general, PT is used as the first choice of treatment, and other therapies are selected after PT is ineffective.

4.2 Extracorporeal Shock Wave Therapy (ESWT)

As a recent research hotpot and a noninvasive treatment, ESWT is usually used to treat fasciopathy. The mechanism of action of ESWT is to produce minor-injury in the fascia, which promote regeneration of capillaries and fibers (Majidi et al., 2024). Clinical studies with 86 PF patients assigned at random to either the observation group (ESWT plus CSI treatment) or the control group (CSI treatment) showed that the observation group had a lower Simplified McGill Pain Questionnaire score at one month (14.50 vs. 17.59, P<0.05) and three months (9.68 vs. 11.97, P<0.05); a higher AOSAF (84.33 vs. 79.01, P<0.05; 89.85 vs. 84.36, P<0.05); lower foot pressure (6.71 vs. 8.26, P<0.05; 4.62 vs. 7.32, P<0.05); and a higher overall effective rate (95.35% vs. 79.07%, P<0.05). This indicates that CSI combined with ESWT has a better result than CSI alone (N et al., 2024). 160 patients were randomly assigned to 4 groups (n=40) in a randomized controlled experiment, and each group was treated with varying frequencies of ESWT: 1Hz for group A, 5Hz for group B, 10Hz for group C and 15 Hz for group D (J et al., 2021). Following treatment, group B had the lowest dynamic plantar pressure (A17.31, B9.82, C11.89, D17.51, P<0.05), along with significantly higher stride lengths (A32.875, B40.800, C33.022, D30.089, P<0.05), support phases (A56.22, B64.64, C61.17, D58.53, P<0.05), and swing phases (A43.78, B35.36, C38.83, D41.47, P<0.05) than the other three groups. This experiment indicates that ESWT at different frequencies showed positive effects in improving plantar pressure and gait, and the treatment frequency of 5hz was the best for ESWL treatment.

4.3 Platelet-Rich Plasma (PRP)

By injecting the patient's own blood plasma with a high concentration of platelets into the treatment site, platelet-rich plasma (PRP) is a promising therapeutic approach. Through lowering inflammation and promoting stem cell activation, PRP helps to heal tendons and ligaments (Zhang et al., 2025). Furthermore, PRP can improve joint range of motion, muscle strength and gait. In a randomized clinical trial, 90 patients suffered from PF with failed conservation treatment were enrolled and were randomly divided into 2 groups(n=45) (Sharma et al., 2023). The two groups were separately treated with steroid injection (steroid group) and PRP (PRP group). The patients had evaluations at the third and sixth months and were monitored for six months. AOFAS and VAS were chosen as the evaluation criteria. The result was, compared with the steroid group, the PRP group has higher VAS score (4.22 vs 3.14, P<0.001) and lower AOFAS score (63.80 vs 75.76, P<0.001) at the third month, but at the sixth month, the PRP group has lower VAS score (1.97 vs 2.71, P<0.05), higher AOFAS score (86.04 vs 81.23, P<0.05) and lower plantar fascia thickness (3.53 vs 4.58, P<0.001). This trail indicates that the short-term efficacy of PRP was not as good as that of steroid injection, but the long-term efficacy was significantly better.

Since the patient's own blood is used to make PRP, it has little side effects and doesn't induce an immunological reaction. Although PRP shows great promise, more clinical study is still needed to determine its precise mode of action and whether there are any possible hazards.

4.4 Acupuncture

Acupuncture is a traditional Chinese medicine treatment that encompasses a variety of therapeutic techniques involving different types on needles. This paper only elaborates on this broad category and does not make a detailed division. Acupuncture effectively reduces pain in PF in the short term efficacy [SMD=1.40, 95%CI(0.63, 2.17), P<0.05], medium term efficacy [SMD=1.07, 95%CI(0.27, 1.87), P<0.05], and long term efficacy [SMD=1.41, 95%CI(0.74, 2.09), P<0.05], according to a meta-analysis of 19 studies that used standardized mean differences (SMD), 95% confidence intervals (CI), and VAS for data analysis and scoring(W et al., 2024). The short-term effect of acupuncture is not obvious in improving the function of foot and ankle, but the medium [SMD=0.61, 95%CI(0.14, 1.09), P<0.05] and long-term [SMD=1.75， 95%CI(1.28, 2.22), P<0.05] effect is better. Moreover, acupuncture can also reduce the thickness of plantar fascia [SMD=1.41, 95%CI (0.51, 2.31), P<0.05]. A separate meta-analysis which selected 32 studies with a total 2390 samples similarly demonstrated the pain reduction of acupuncture compared to placebo treatment [mean difference (MD)=-1.33, 95%CI (-2.19, -0.46)] (Asokumaran et al., 2024). This analysis suggests that acupuncture should be as a second-line therapy for PF together with other treatments including ESWT and PRP. The small needle-knife treatment is comparable to ESWT in terms of short-term pain relief [MD=2.20, 95%CI(-2.77, 7.16), p=0.39] and healing [odds ratio(OR)=1.87, 95%CI(0.80, 4.37), p=0.15], but may be better than

ESWT in medium-term pain relief [MD=9.11, 95%CI(5.08, 13.15), p<0.00001] and long-term [MD=10.71, 95%CI(2.18, 19.25), p<0.00001], according to another meta-analysis comparing the two methods for treating PF(Feng et al., 2024).

However, acupuncture has certain shorts. The therapist should have sufficient treatment experience in treating with PF and the medical compliance of it is relatively low. Furthermore, the long-term outcomes still need further research.

5 PREVENTION

Firstly, stretching after exercises is a good way to avoid dorsiflexion limitation of ankle, which decreased the main risk factor of PF. Secondly, in order to improve ankle stability and arch support, it is important to train the Buttock muscles, Lower leg muscles and plantar muscle group. But it is important noticing that overtraining or standing for long period of time should be avoid. Moreover, gait pattern should be emphasized in daily life. Gait assessment can be performed and a professional therapist sought for gait correction. Weight management and supportive footwear with adequate cushioning can also be chosen to release plantar fascia pressure.

6 CONCLUSION

This article summarized the cause, diagnosis, treatment and prevention of PF. There are many causes of PF encompass range of ankle dorsiflexion, age, plantar fascia thickness, body mass index (BMI) and long-term weight. For diagnosis, history, clinical evaluation and US can make the diagnosis conveniently and quickly. In daily life, patients can also self-test by symptoms and physical examination. In the terms of treatment, PT, ESWT, PRP and acupuncture have their own characteristics, and all of these treatments can reduce the VAS and improve AOFAS. PT is widely used treatment with highly safety. It is easy for patients to adhere it for a long time and can obtain good long-term curative effect. ESWT is an effective method in promoting fascia regeneration and reduce adhesion, thus can quickly relieve pain and improve gait. PRP is a promising method with good efficacy in lower plantar fascia, but has a higher price due to its tedious and high demanding preparation. Acupuncture, as a traditional Chinese medicine treatment, is totally worth trying because of its good pain relief in the medium and long term. However, its medical compliance is poor and requires long-term adherence. Each treatment method needs to be selected according to the actual situation and personal wishes of patients. As for prevention, patients should be aware of possible symptoms at all times in their daily life. Measures such as stretching, strengthening, and weight management should be incorporated into everyday life. This article fills the gap of the lack in systematic combing and analysis of the treatment of PF, provide a reference in managing PF for the majority of the patients and can also facilitate other researchers to expand their understanding of PF. In the future, more in-depth studies on the treatment of PF need to be carried out, and a more detailed criterion for the selection of treatment methods for PF should be specified in order to obtain the optimal treatment regimen.

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