



# Plantar Fasciitis: Clinical Aspects

**Andreas Stevan**

Depati Bahrin Regional General Hospital, Sungailiat, Bangka, Indonesia

## ABSTRACT

Plantar fasciitis is a common degenerative disease involving connective tissue in heel pad area, indicated with exquisite pain and tenderness over the plantar medial tuberosity of the calcaneus at the proximal insertion of the plantar fascia. The pain often worse in the morning and gradually decreases during the day. The incidence is highest among active adults. A common misconception is that pain is caused by the bone spurs bulging from the heel and “digging” into the surrounding tissue; the pain is actually caused by the micro tears and inflammation due to stiffness. Most cases resolve regardless of therapies given. Nonsurgical and surgical treatments are available as indicated.

**Keywords:** Heel pad, pain, plantar fasciitis

## ABSTRAK

Plantar fasciitis merupakan penyakit degeneratif umum melibatkan jaringan ikat daerah tumit kaki yang ditandai nyeri khas di daerah tuberositas plantar medial kalkaneus pada insersi proksimal plantar fascia. Nyeri umumnya dirasakan pada pagi hari saat bangun tidur dan berkurang setelah beraktivitas. Kondisi ini sering terjadi pada orang dewasa aktif. Miskonsepsi yang sering dikaitkan dengan tulang tumbuh yang “menusuk” jaringan lunak di sekitar insersi fascia, padahal lebih dikaitkan dengan sobekan mikroskopis dan inflamasi karena kekakuan jaringan ikat. Kebanyakan kasus sembuh sendiri tanpa pengobatan. Terapi non-bedah atau bedah sesuai penyebab dan indikasi. **Andreas Stevan. Aspek Klinis Plantar Fasciitis**

**Kata kunci:** Nyeri, plantar fasciitis, tumit kaki

## INTRODUCTION

The foot serves several important basic functions such as propulsion through space, adaptation for walking on uneven terrain, shock absorption, and supporting the whole body weight during and static and dynamic positions. Given these important basic functions and taking into account that we use our leg and feet every single day for any single task, there's no way it would perform as smooth for as long as we live. Some may have congenital problems, some earn it during childhood, and some are caused by infection, inflammation, and degeneration.

Structures in the foot consisting of bones, muscles, ligaments, arteries, veins, nerves, and other surrounding soft tissues play important roles in supporting each other. Problems may arise just by having a single structure difficulty. This article discusses the soft tissue on the heel called plantar fascia. The inflammation of this structure is diagnosed as plantar fasciitis.

Plantar fascia which is a ligament extending

from the heel to the toes; the inflammation causes throbbing pain on the heel, mostly felt in the mornings and gradually decreases with moderate activities. The condition usually is felt gradually without any clear incident or injury; occasionally there is a history of a sudden increase in a sporting activity or a change of footwear, sports shoes or running surface.<sup>1</sup> Although this condition is very common, the cause of the pain is misunderstood to be the bone spur digging into the surrounding tissue.

There is no report on the prevalence of plantar heel pain in Indonesia.<sup>11</sup> In the United States, plantar heel pain is the most common reason for visits to foot and ankle specialists, accounting for 1 – 2 million annual visits.<sup>3,7,12</sup>

### Anatomy

The plantar fascia or plantar aponeurosis is a dense fibrous tissue originating from the medial calcaneal tubercle supporting the arch of the foot through the heel fat pad which will be divided into medial, central, and lateral part, continues distally with slips to each toe.

Even though the term plantar fascia and plantar aponeurosis sometimes interchangeable, there is an exact definition to define each term. The medial and lateral parts attach to the abductor hallucis and the musculus abductor digiti quinti pedis, respectively. These parts are usually categorized as fascia. The central part is thicker and is considered an aponeurosis.<sup>2</sup>



**Figure 1.** LP = Lateral Part, CP = Central Part, MP = Medial Part, L = Length, W = Width.<sup>2</sup>

The plantar fascia also serves its function to bear whole body weight via windlass mechanism preventing the foot arch from separating and collapsing. The windlass mechanism, in general, is a mechanical model that provides



a thorough explanation of biomechanical factors and stresses. The windlass mechanism on the plantar fascia describes the state of the plantar fascia in weight-bearing activities and may provide information regarding the biomechanical stresses exerted on the plantar fascia. This information plays a role in helping to determine the causative factor of this disease and may also help to provide the best treatment possible, preventing recurring symptoms.

Vertical forces from the body weight travel down via the tibia and flatten the medial longitudinal arch. Ground reaction forces travel upwards on the calcaneus and metatarsal heads forming a triangular shape of forces which further attenuate the flattening effect of the foot arch because these forces fall on the posterior and anterior to the tibia. The essence of the windlass mechanism located in the winding function of the plantar fascia, which shortens the distance between the calcaneus and metatarsals to elevate the medial longitudinal arch during dorsiflexion resulting in propulsive phase of gait.



**Figure 2.** The forces occurring on the foot. Downward arrow depicts the body's vertical forces. The upward arrows depict the ground reaction force.<sup>4</sup>

**Pathology**

Biomechanics stresses are exerted on foot despite the differences of the foot arch. A lower-arched foot patient may experience plantar fasciitis resulting from too much motion, whereas higher-arched foot patient may have the condition from having too little motion.<sup>4</sup>

Stresses exerted on the structure of the plantar fascia may cause the fascia to experience micro tears resulting in inflammation of the surrounding tissue. These tears will result in the thickening of the fascia due to fibrosis, further reducing the elasticity, creating a continuous loop of micro tears – inflammation – fibrosis – reduced elasticity. Histopathologic studies

have shown that patients with plantar fasciitis have more disorganization of fibrous tissue similar to degenerative tendinosis rather than inflammation. Furthermore, the plantar fascia stiffens and becomes less pliable with age in accordance with degenerative disease.<sup>1,3</sup>

This contradicts the common misconception that plantar fasciitis is caused by the bone spur seen in the plain lateral x-ray of the foot, “digging” into the surrounding tissue and causing the inflammation; fixating the idea of treatment is to remove the sharp bony spur.<sup>1-4</sup> This “spur” is actually caused by a high tension in the fascia causing a periosteal lifting at its insertion on the calcaneus, and bony healing could cause the growth of the spur we commonly see in the plain lateral foot x-ray. It is important to emphasize that the spur is not the main cause of the pain; also taking considerations that some patients with plantar fasciitis have no bone spur on their foot x-rays and people with bone spur doesn't always exhibit pain on the heels.

Current literatures state that plantar fasciitis is more correctly termed fasciosis because of the chronicity of the disease and the evidence of degeneration rather than inflammation.<sup>3</sup>

**Epidemiology**

Plantar fasciitis is considered a self-limiting disease with variable healing periods ranging from weeks to months and even years, and most patients would seek professional help. The peak incidence of plantar fasciitis occurs between 45 and 64 years old and it is more common among women. Other at-risk populations may include people with flat or high-arched heels as explained above, people with vigorous activities, people with occupations requiring prolonged standing, and people who are obese or sedentary and up to one-third of patients may present with bilateral plantar fasciitis.<sup>7</sup>

**Risk Factors**

Multiple factors should be taken into considerations in determining the aetiology of this disease which can be assessed on the basis of history and physical examinations.

The factors may be divided into two common intrinsic and extrinsic factors (Table 1). Intrinsic factors are associated with body characteristics and include anatomic, functional, and

degenerative factors, while extrinsic factors are associated with physical activities and include overuse, incorrect training or pose and inadequate footwear.

**Clinical Features**

Localized tenderness over the heel pad area is the primary symptom. Pain characterized as severe in mornings or after a rest that improves over the day with more moderate activities greatly signifies this condition.

Physical examination finding is typical tenderness over palpation on the heel pad area, sometimes extending to the middle area of the foot. Some patients may find discomfort with passive dorsiflexion of the first toe.<sup>3</sup>

**Diagnosis**

Diagnosis is mainly through history and general physical examination of the foot, marked by the classic symptom of heel pain felt mainly in the mornings or after a period of rest, and markedly decreased during the day or with more moderate activities.

The main approach to diagnose plantar fasciitis is to palpate both medial tubercle of the calcanei and the proximal part of the plantar fascia. Evaluation of intrinsic and extrinsic factors should always be taken into account in making a firm diagnosis preventing future recurrences.

Further investigations such as blood samples, ultrasound, plain lateral x-ray, and MRI are not routinely done except on severe, recurring, persistent, or having no response despite any treatments in which further investigations are needed to rule out any other possible diseases involving the joints, muscles, ligaments, and nerves.<sup>1,6,10</sup> Musculoskeletal ultrasonography is useful and reliable tool as it is well-tolerated, non-invasive imaging without ionising radiation.<sup>10</sup> The plantar fascia thickness in asymptomatic healthy adults ranges from 3.3 ± 0.3 mm to 3.9 ± 0.5 mm and thickness greater than 4.0 mm is considered abnormal.<sup>10</sup>

Although commonly used in diagnosing musculoskeletal problems, plain radiography has limited value and should not be used to make a diagnosis of plantar fasciitis without clinical history and physical examination findings, but it may help excluding other possibilities such as calcaneal fracture<sup>1,10,13</sup>.

## TINJAUAN PUSTAKA



Bone spur on the plain lateral foot x-ray can be found in 50% plantar fasciitis patients. However, its relationship to subcalcaneal pain has not been established.<sup>10</sup>

### Differential Diagnosis

Although plantar fasciitis is the common cause of plantar heel pain, some conditions are worth taking into considerations. Most of which are easily excluded following a comprehensive history and physical examination.

### Treatment

Although the natural history of plantar fasciitis is often self-limited, some patients are seeking professional help as it is considered to limit their activities due to the throbbing and recurring pain.

Many treatments available are divided into

two main groups of non-operative and operative treatments. The easiest method for the patient may be taken into considerations while monitoring for improvements. Patients' diligence on maintaining the treatment is one of the main factors to a satisfying outcome.

Conservative and multimodality treatments are the most common and generally advised treatment options by most physicians as the nature of this condition is known to be self-limiting. These multimodality treatments of rest, heat, ice pack, NSAIDs, stretching, orthotics, or extra-corporeal shockwave therapy may be done in combinations according to the complaints, clinical condition, and the challenges the patient are going through for the treatments advised. Researchers have not determined the most effective combination of treatments.<sup>6,14-16</sup>

It is stated that NSAID is one of the worst interventions considering overall efficacy and showed no superiority over placebo. However when used in combination with other forms of treatment, it has been shown to be an adequate means of pain control.<sup>7,17</sup>

Corticosteroid injection is still a common practice among practitioners as it provides quick pain relief, but short lasting. Multiple administration of corticosteroid injection may cause fascia rupture and infection.<sup>8</sup>

Other instruments such as orthotics, splints, and extra-corporeal shock wave therapy may be used to treat the condition, and specific stretching exercises are the best statistically significant long-term result.<sup>8,9</sup> Specific stretching exercise is very easy to do at home and should provide the best result if done regularly. The calf and arch stretch using a towel is performed before going to sleep and before taking the first steps in the morning. Pull back on foot for 30 seconds 3 ties with 30 seconds rest in between (Figure 3).

Table 1. Intrinsic and extrinsic factors in plantar fasciitis.<sup>3,8</sup>

Intrinsic Risk Factors		Extrinsic Risk Factors	
Anatomic	Obesity	Environmental	Poor biomechanics or alignment
	Flat foot		Deconditioning
	High arched foot		Walking on hard surface
	Shortened Achilles tendon		Walking barefoot
	Leg-length discrepancy		Repetitive and sudden impact loading on foot
	Overpronation of foot		Prolonged weight bearing
	Excessive lateral tibial torsion		Inadequate stretching before exercise
	Excessive femoral anteversion		Poor footwear
	Biomechanics		Overpronation
Limited ankle dorsiflexion			
Weak muscles of the foot			
Degenerative	Heel fat pad aging		
	Heel fat pad atrophy		
	Plantar fascia stiffness		

Table 2. The differential diagnosis of plantar fasciitis.<sup>3,6</sup>

Type	Diagnosis	Findings
Neurologic	Tarsal tunnel syndrome	Burning sensation in the plantar region, worsen by dorsiflexion.
	Diabetic neuropathy	Paresthesias in plantar region
	Boxter's nerve entrapment	Pain is more proximal and dorsal, no sensory disturbance
	Spinal stenosis and L5 – S1 nerve root irritation	Similar symptoms and signs on the following dermatome
Skeletal	Acute calcaneal fracture	History of trauma
	Calcaneal stress fracture	Seen in runners
	Calcaneal apophysitis	Seen in paediatric patients with open physes
	Calcaneal bursitis	Burning, throbbing pain with swelling and erythema of posterior heel
	Rheumatoid arthritis	Multiple joints pain
Soft tissue	Fat pad atrophy	Common in elderly
	Fat pad contusion	History of trauma
	Achilles tendinitis	Posterior calcaneal tenderness with Achilles tendon pain
	Retrocalcaneal bursitis	Pain in retrocalcaneal bursa
	Posterior tibial tendinitis	Pain along posterior tibial tendon and at insertion mid foot at the arch
	Plantar fascia rupture	Sudden, acute, sharp pain with bruising.



Figure 3. Calf and arch stretch using towel.<sup>3</sup>



Figure 4. Manual plantar fascia stretch.<sup>3</sup>



Figure 5. Roll plantar fascia with a can or ball.

Manual plantar fascia stretch with cross friction massage is done before taking first steps for 1 minute 3 times with 30 seconds of



rest in between (Figure 4). Roll plantar fascia with a can or ball before taking first steps in the morning for 1 minute 3 times with 30 seconds of rest in between (Figure 5).<sup>3,10</sup>

Surgical treatments are considered as last resort option; 75% of patients who underwent surgical intervention after failed conservative treatment reported a substantial or complete reduction in heel pain.<sup>7</sup>

### SUMMARY

Plantar fasciitis is considered as a self – limiting disease with variable healing periods ranging from weeks, months and even years with peak incidence within around 45 to 65 years

old and it is more common among women than men. Other populations such as people with high-arched heels, vigorous activities, prolonged standing, and who are obese also more susceptible to this condition. It is now believed that the main culprit of this condition is the degeneration of the plantar fascia which may be caused by intrinsic or extrinsic factors.

Physical examination finding is the typical tenderness over palpation of the heel pad area which sometimes may extend to the middle area of the foot. Further investigations such as blood samples, ultrasound, x-ray, and MRI are not necessarily done except on certain conditions and sometimes to rule out other

possible causes.

Conservative and multimodality treatment is still the most generally advised treatment considering the self-limiting nature of this condition. Treatments should always be tailored individually, consist of a combination of rest, heat, ice pack, NSAIDs, stretching, orthotics, or ESWT. More invasive treatment such as corticosteroid injection is still a common practice for providing rapid pain relief with considerations of complications in the future. Surgical treatments are considered as last resort option after conservative or minimally invasive treatments failed.

### REFERENCES

1. Solomon L, Warwick D, Nayagam S. *Apley's system of orthopaedics and fractures*. 9<sup>th</sup> ed. London: Hodder Arnold; 2010.
2. Chen DW, Li B, Aubeeluck A, Yang YF, Huang YG, Zhou JQ, et al. Anatomy and biomechanics properties of the plantar aponeurosis: A cadaveric study. *PLOS One*. 2014;9(1):e84347.
3. Emily NS, John S. Plantar fasciitis: A concise review. *Perm J*. 2014;18(1):105-7.
4. Lori AB, Malone TR. Plantar fasciitis and the windlass mechanism: A biomechanical link to clinical practice. *J Athl Train*. 2004;39(1):77-82.
5. McRae R. *Clinical orthopaedic examination*. 6<sup>th</sup> ed. UK: Churchill Livingstone Elsevier; 2010.
6. Tahirian MA, Motifiifard M, Tahmasebi MN, Siavashi B. Plantar fasciitis. *J Res Med Sci*. 2012;17(8):799-804
7. Thompson JV, Sundeep SS, Christopher W, Daniel JN. Diagnosis and management of plantar fasciitis. *J Am Osteopathic Assoc*. 2014;114(12):900-6
8. Petragila F, Ramaazzina I, Costantino C. Plantar fasciitis in athletes: Diagnostic and treatment strategies. A systematic review. *Muscle, Ligaments, and Tendons J*. 2017;7(1):107-18
9. Attar SM. Plantar fasciitis: A review article. *Saudi J Intern Med*. 2012;2(1):1433-2012.
10. Lim AT, How CH, Tan B. Management of plantar fasciitis in the outpatient setting. *Singapore Med J*. 2016;57(4):168-71
11. Purvitagiri NKM, Dewanti L, Bayusentono S, Wardhani IL. Correlation between prolonged standing and plantar fasciitis. *J Orthop Traumatol Surabaya*. 2017;6(1):33-9
12. Miller LE, Latt DL. Chronic plantar fasciitis is mediated by local hemodynamics: Implications for emerging therapies. *N Am J Med Sci*. 2015;7(1):1-5
13. Draghi F, Gitto S, Bartolotto C, Draghi AG, Belometti GO. Imaging of plantar fascia disorders: Findings on plain radiography, ultrasound, and magnetic resonance imaging. *Insights Imaging*. 2017;8(1):69-78
14. Chen CM, Lee M, Lin CH, Chang CH, Link CH. Comparative efficacy of corticosteroid injection and non-invasive treatments for plantar fasciitis: A systematic review and meta-analysis. *Scient Rep*. 2018;8:4033
15. Mittal V, Nagakumar JS, Asok WU, Aron HS. Plantar fasciitis treatment: What is better, oral nonsteroidal anti-inflammatory agents or locally injectable steroid? *Internat J Orthopaed Sci*. 2018;4(1):247-51
16. Katzap Y, Haidukov M, Berland OM, Itzhak RB, Kalichman L. Additive effect of therapeutic ultrasound in the treatment of plantar fasciitis: A randomized controlled trial. *J Orthopaed Sports Phys Ther*. 2018;48(11):847-55
17. Li H, Hao LV, Lin T. Comparison of efficacy of eight treatments for plantar fasciitis: A network meta-analysis. *J Cell Physiol*. 2019;234:860-70