



Review on Assessment Tools for Clinical Diagnosis of Plantar Fasciitis

Shubhi Kulshrestha^{1*}, Shubham Sharma² and Sukriti Raj³

¹Senior Physiotherapist, AID PLUS Physiotherapy and Rehabilitation Clinic, Delhi, India

²Assistant Professor, Santosh Medical College, Ghaziabad, Uttar Pradesh, India

³Physiotherapy Faculty, Impact Paramedical and Health Institute, New Delhi, India

*Corresponding Author: Shubhi Kulshrestha, Senior Physiotherapist, AID PLUS Physiotherapy and Rehabilitation Clinic, Delhi, India.

Received: August 22, 2022

Published: September 28, 2022

© All rights are reserved by Shubhi Kulshrestha, et al.

Abstract

Background: Plantar fascia (PF) plays an important role in maintaining the normal ankle biomechanics as it has a significant role in weight-bearing both in static and dynamic balance. Various structural as well as functional roles have been indicated with the virtue of its anatomical attachments as during weight bearing tibia loads the foot and creates the tension through the plantar fascia commonly called as the windlass mechanism. The tension created in the PF adds a critical amount of stability to a weight-bearing foot with minimal muscle activity. PF also acts as a shock absorbent as it provides the support to the arch of the foot. At least 80% of the general population has foot problems, but these problems can often be corrected by proper assessment and treatment but above all caring for the feet. Injuries to ankle and foot can alter the mechanism of gait (walking pattern) which can alter the biomechanics of the complete lower limb leading to various pathologies. One of the prevalent conditions is plantar fasciitis caused by the inflammation of plantar fascia.

Objective: To identify the latest method of clinically diagnosing Plantar fasciitis, physical examination of Plantar fasciitis. To know the disabling symptoms faced by patients, the methods to rule out plantar fasciitis from various other symptoms.

Methods: Database-specific search terms and certain keywords were sorted into different concepts for plantar fasciitis and its clinical diagnostics. With these concepts, the keywords were searched individually on different search mediums like Google scholar, Cochrane, PubMed and Medline. The outcome measured used were- type of study, author name and year of study, number of participants, purpose of study, protocol or method used and the outcome concluded. Pedro scale was used as quality assessment tool. The Pedro scale was developed to help Pedro users to rapidly identify trials that are likely to be internally valid and have sufficient statistical information to guide clinical decision-making.

Results: A total of 59 available literature was found out of which 48 were excluded because of lack of availability of full text and involvement of surgical procedure, only 11 were selected.

Conclusion: For radiological diagnosis ultrasonic is found to be one of the most effective modality for confirming plantar fasciitis as compared to other modalities as it is cost-efficient but certain tools need to be developed for a quick examination of plantar fasciitis so that the treatment can be planned accordingly. Being one of the most prevalent conditions it should be considered for a reliable diagnosis.

Keywords: Plantar Fasciitis; Heel Pain; Clinical Diagnosis

Introduction

At least 80% of the general population has foot problems, but these problems can often be corrected by proper assessment and treatment but above all caring for the feet [1]. Injuries to ankle and foot can alter the mechanism of gait (walking pattern) which can alter the biomechanics of the complete lower limb leading to various pathologies. One of the prevalent conditions is plantar fasciitis caused by the inflammation of plantar fascia [2].

Plantar fascia (PF) plays an important role in maintaining the normal ankle biomechanics as it has a significant role in weight-bearing both in static and dynamic balance. Various structural as well as functional roles have been indicated with the virtue of its anatomical attachments [3] as during weight bearing tibia loads the foot and creates the tension through the plantar fascia commonly called as the windlass mechanism [4]. The tension created in the PF adds a critical amount of stability to a weight-bearing foot with minimal muscle activity. PF also acts as a shock absorbent as it provides the support to the arch of the foot.

Plantar Fasciitis is the inflammatory injury of the fascia of the foot. This plantar fascia which is also known as plantar aponeurosis is a thick ligamentous tissue that originates from the heel bone and connects to the toes. Its main function is to absorb any kind of shock and other stresses which can occur when the foot hits the ground. It also helps in stabilizing the arch of the foot.

The collagenous degeneration of the PF around its origin i.e. calcaneal tuberosity of the heel as well as the surrounding perifascial structures is called as plantar fasciitis or plantar heel pain [4] (PHP). It has impacted the lives of millions of people around the globe. It is estimated that diagnosis and treatment of PHP accounts for over a million visits to physicians [5] per year and a rough amount of \$284 million is spent [6] on it in the United States. It is found that nearly 10% of the population will suffer from PHP at some point in life [7].

The etiology of PHP is multifactorial like obesity, pes planus, shortened Achilles tendon, prolonged weight bearing, inadequate stretching and biomechanical abnormalities [8]. It is evaluated that patients who have a history of gout or some seronegative spondyloarthropathies have increased incidence of PHP. Most patients are treated with conservative management but estimated 1% may require surgery [5].

It is believed that PHP is quite more in morning as at night the foot (mostly) falls in plantarflexion and as the individual arise from the bed in the morning or after rest the foot moves to dorsiflexion we can say that PF contracts at night and its initial stretching because of walking may cause pain [5].

While many individual are suffering from PHP; there are variety of differential diagnosis which may produce these symptoms [9], these conditions are mainly reiters syndrome, osteoarthritis, rheumatoid arthritis, abscess, soft tissue contracture, infection or entrapment of first branch of lateral plantar nerve, medial calcaneal nerve, S1 radiculopathy or an occult fracture.

The diagnosis of plantar fasciitis is symptomatic yet further investigations can be carried out depending on the clinical presentation. The most common radiological investigations that are being carried out are X-rays (plain). X-rays commonly represents the calcaneal spur in 50% of the cases [10], which may or may not be related to PHP. In a study conducted by tezel. N., *et al.* in 2020 diagnosis of PHP was supported by ultrasonography (USG) with those having a thickness of >4 mm [11]. Technetium bone scintigraphy is positive in plantar fasciitis, with the maximum area of uptake at the point of maximum tenderness on the heel. Bone scintigraphy also shows an area of increased uptake in the presence of an occult fracture. Electromyography may be helpful if a neurogenic cause is suspected such as S1 nerve root entrapment, tarsal tunnel syndrome or entrapment of the lateral plantar nerve. Magnetic resonance imaging is not a routine investigation in plantar fasciitis but can identify other soft tissue lesions such as soft tissue tumors or the marrow edema associated with infection or if an occult fracture is suspected [12]. Depending on the overall clinical picture, the physician may also perform blood tests such as a white cell count, human leucocyte antigen B27, antinuclear antibodies and uric acid, particularly in the younger patients or with those patients who have bilateral heel pain.

Physical examination of PHP includes windlass test which includes passive dorsiflexion of patient's toes. A positive test indicates pain at the insertion of the PF. This test is carried out by a physical therapist. De Garceau., *et al.* showed 100% specificity for weight bearing and sensitivity of 32% for non-weight bearing tests [13,14].

Need of the study

Diagnostic imaging has been used by many practitioners regarding plantar fasciitis; these imaging types include multiple methods. The purpose of the study is to review and appraise previously reviewed articles that evaluate the clinical diagnosis of plantar fasciitis.

Aims and Objective

- To identify the latest method of clinically diagnosing PHP
- To know about the physical examination of PHP
- To know the disabling symptoms faced by patients
- To understand the methods to rule out PHP from various other symptoms.

Methodology

Search strategy

Database-specific search terms and certain keywords were sorted into different concepts for plantar fasciitis and its clinical diagnostics. With these concepts, the keywords were searched individually on different search mediums like Google scholar, Cochrane, PubMed and Medline. Subject terms and keywords were combined to remove the duplicates. Certain conjunctions like OR, and were used to obtain a result. The search strategy is described in table 1 - Appendix section. Targeting searching of relevant journals also occurred following the bibliographic review of retrieved articles.

Inclusion criteria

- Articles are published in English language.
- Studies including the clinical diagnosis of plantar fasciitis
- Full free text articles available on internet.
- Randomized control trial, prospective studies, cross-sectional studies and cohort study was included.
- Intervention studies were included if the baseline clinical diagnosis were incorporated.

Exclusion criteria

- Articles in any other language except English.
- Case control studies

- Surgical intervention
- Articles including any other conditions except plantar fasciitis.

Data extraction

The outcome measured used were- type of study, author name and year of study, number of participants, purpose of study, protocol or method used and the outcome concluded.

Quality analysis

Pedro scale was used as quality assessment tool. The Pedro scale was developed to help Pedro users to rapidly identify trials that are likely to be internally valid and have sufficient statistical information to guide clinical decision-making. Each trial report is given a total Pedro score, which ranges from 0 to 10.

Result

Study population

Several of databases were searched like Medline, PubMed, and Cochrane. A total of 59 studies were found out of which only 11 were included as they met the inclusion criteria.

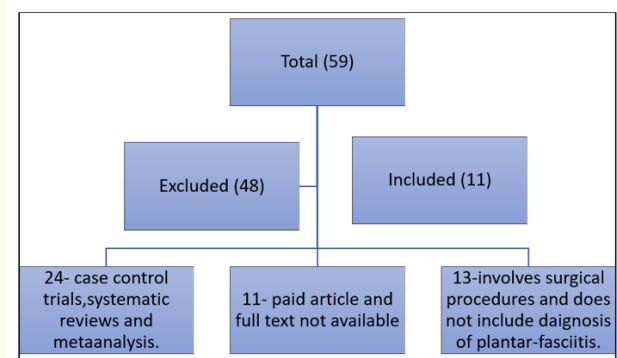


Figure 1: Overview of the studies included.

The following reviews were generated and is stated chronologically.

Discussion

The purpose of the study was to systematically review and appraise using proper tools the previously published literature in past 10 years i.e. 2010-2020 that evaluate the clinical diagnosis

Author and year	Type of study	Sample size	Purpose	Protocol	Conclusion	PEDro score
Kapoor, <i>et al.</i> in 2010	Prospective study	25 participants (11 male and 14 female)	To evaluate the role of elastography in evaluating plantar fasciitis compared with diagnostic ultrasound and MRI	Images were obtained in the longitudinal plane parallel to the PF by linear transducer	The combination of elastography with ultrasound improves the accuracy of diagnosing plantar fasciitis with results being compared to the MRI.	7
Groshar, <i>et al.</i> in 2010	A randomized control trial	43 participants (19 male, 24 female)	To evaluate the accuracy of bone scintigraphy and diagnostic ultrasound in evaluating and diagnosis ultrasound	Ultrasound transducer was aligned longitudinally with the plantar fascia. Patients were in prone lying with feet hanging off the examination table.	Plantar fascia thickness: symptomatic feet- 5.3 mm±1.7mm. Positive predictive value: greater than 3.9mm=84.3%Also, 70.7% symptomatic heels were positive for hypoechoogenicity.	8
Fabrikant and park in 2011	Prospective study	63 participants	To compare the baseline plantar fascia thickness with the faces pain rating scale	Longitudinal sonograms by patients sitting with feet over the table edge and the foot should be in slight plantarflexion. The thickness is measured from the base of the medial calcaneal tubercle.	Office based ultrasonography can help diagnose and confirm plantar fasciitis as a non-invasive, cost effective and radiation free diagnostic modality.	7
McMillan, <i>et al.</i> in 2012	Randomized control trial	43 participants (19 male and 24 female)	To investigate the effectiveness of ultrasound guided corticosteroid injection in the treatment of plantar fasciitis	Images were obtained were the fascia crosses the anterior aspect of the inferior calcaneal border	At baseline evaluation, ultrasonography successfully diagnosed all patients with plantar fasciitis.	7
Vahdatpour B., <i>et al.</i> in 2012	Randomized control trial	20 participants (7 male 13 female)	To know the subjective assessment and treatment outcome using extracorporeal shock wave therapy for the diagnosis of plantar fasciitis	Ultrasonographic evaluation was carried out before and after ESWT and quantitative assessment using NRS was done.	At baseline, ultrasound was able to detect the morphological changes in the plantar fascia while ESWT can contribute to healing and pain reduction in the Plantar fasciitis	9

Chen., <i>et al.</i> in 2013	Cross sectional study	38 participants	To assess the accuracy of ultrasonography in diagnosing patients with chronic plantar fasciitis compared with a clinical examination	Ultrasound was used to capture the images both grey scale as well as power Doppler	Ultrasonography was found to be a successful tool in diagnosing pathological and detective changes in the plantar fascia. The vasculature of the PF can be related to the development of plantar fasciitis.	8
Danilo F, <i>et al.</i> 2015	Randomized control trial	83 participants	To know the effect of stretching with and without strengthening exercise for foot pain in case of plantar fasciitis	Measures of assessment of plantar fasciitis used were visual analog pain scale (VAS), Ankle outcome score and star excursion balance test	At baseline, the diagnosis was made using the measures before and after the treatment. No time group interactions were found for any of the variables.	9
Lopez p., <i>et al.</i> in 2018	Cross-sectional study	100(49 males,51 females)	To know the impact of plantar fasciitis on quality of life	Participants were examined on the basis of their medical record and ultrasonography with a 5-10 MHz range linear transducer and foot health status questionnaire was used to assess the quality of life	Inclusion criteria were based on the diagnosis done by the assessor. Researchers and clinicians should pay special attention regarding heel health.	7
Thong-On S., <i>et al.</i> 2019	Randomized-control trial	84 participants	To know the effect of stretching as well as strengthening exercise on the temporospatial parameters in patients suffering from plantar fasciitis	Patients were screened with unilateral or bilateral plantarfacitis with a history of heel pain with few steps in the morning, pain and tenderness on palpation, thickness of fascia greater than 4mm.plantarfascitiis was assessed by portable digital ultrasound diagnosis system	The participants were evaluated 5 times, at baseline, intermediate of intervention, end of intervention, 1 and 2 month follow-up at the end of the intervention. There is so difference in testing parameters of plantar fasciitis.	8
Grim C., <i>et al.</i> in 2019	Randomized control trial	63 participants (19 male, 44 female)	To understand the effectiveness of the foot orthotics, manual therapy and combined therapy to treat plantar fasciitis	Participants were screened using foot and ankle society- ankle hind foot scale, (AOFS-AHS) passive range of motion and foot pain and function scale. Confirm diagnosis was done by foot and ankle surgeon	AOFS-AHS include patient reported pain and function it gives the outcomes of SF-36. Here have been no reliable data published regarding the minimal clinically important difference between the two.	9

Tezel N., <i>et al.</i> in 2020	A randomized control trial	36 participants	To know the effectiveness of kinesio-tapping and extracorporeal shockwave therapy for treating plantar fasciitis	Diagnosis was based on symptoms, physical examination and supported with ultrasonography evaluation for those having a fascia thickness of more than 4 mm	in patients with bilateral involvement, only the foot that was more affected, as Reported by the patient, was selected; therefore, only one foot per patient was included in the study. The included foot of the patients was assessed before and after treatment for pain and functionality using evaluation scales.	7
---------------------------------	----------------------------	-----------------	--	---	---	---

Table 1

of PF for both subjective as well as objective examination. There are many qualitative diagnostic method for the assessment of PF including ultrasonic, MRI, elastography, faces pain rating scale whereas no quantitative method for the assessment of PHP. The only Quantified scales used in different studies were VAS, NRS, SF-36 and AOFS-AHS which cannot confirm the clinical diagnosis of plantar fasciitis.

Sven out of eleven articles were randomized control trial [11,15-20], the rest four were identified as prospective study and cross-sectional study [21-24]. The gender distribution of females with the case of PF is greater in maximum number of cases. Another prominent trend which was found was that participants were mostly overweight to obese.

Patient positioning was quite consistent between the articles which were mostly prone lying with feet off the examination couch. The foot was in neutral position with slight dorsiflexion, diagnosing the PHP utilizing longitudinal and transverse waves.

Included studies appraise the use of mostly similar tools for the diagnosis of PHP. Studies compared the use of diagnostic ultrasound with ultrasound, scintigraphy, elastography and clinical examination to accurately diagnose PHP. MRI based electrographic assessment were present in literature was used to measure the thickness, echogenicity, stiffness and interfacial changes of PF [21].

During ultrasonography assessment of the plantar fascia, the most common outcome measure utilized was the plantar fascia thickness (at site of calcaneal insertion), utilized in nine out of the total 10 articles [20-22]. Plantar fascia thickness as measured by ultrasound ranged from 4.2 ± 1.1 mm to 6.67 ± 1.53 mm for all study groups, using any thickness above 4.0 mm as a positive result. Other prevalent features assessed by the US were echogenicity, presence of bony spurs, presence of perifascial fluid, biconvexity of the plantar fascia at its origin compared to middle and distal thirds, and vascularity of the plantar fascia. MRI similarly assessed thickness of the fascia, as well as enthesopathy associated with ligamentous rupture. Significant diagnostic factors commonly referenced throughout the articles which were used as diagnostic criteria that may not have been represented by imaging modalities included the patient's apprehension of pain, the heel tenderness index (HTI), visual analog scale for pain, vascularity index (VI) and the foot function index (FFI).

Certain special test and functional assessment can be carried out by the examiner to assess the PHP. These tests are most commonly done by a physiotherapist. The literature applicability was not used is any of the article. As these test have a reliability of 0.78 which is good. Also quantified scales were not used in any article.

Limitation of the study

- There was not much literature to that includes the clinical diagnosis of PHP.

- The studies included the intervention
- The clinical diagnosis was not given properly
- The sensitivity and validity values of the diagnostic procedures were not given in any article.

Future scope of the study

Since PHP is one of the most prevalent conditions a tool for a quick clinical diagnosis can be developed. The patient experience stabbing pain which is crucial in morning certain intervention can be developed to treat that. Further a trial can be done to assess PFP using different mediums which can be done in Physiotherapy OPD.

Conclusion

For radiological diagnosis ultrasonic is found to be one of the most effective modality for confirming plantar fasciitis as compared to other modalities as it is cost-efficient but certain tools needs to developed for a quick examination of plantarfacitis so that the treatment can be planned accordingly. Being one of the most prevalent conditions it should be considered for a reliable diagnosis.

Conflicts of Interest

The Authors declare that they have no conflict of interest.

Bibliography

1. David Maggie: Saunders 9781455709755, Professor Department of Physical Therapy Faculty of Rehabilitation Medicine University of Alberta Edmonton, Alberta, Canada, (2014).
2. McMillan AM., et al. "Ultrasound guided injection of dexamethasone versus placebo for treatment of plantar fasciitis: protocol for a randomised controlled trial". *Journal of Foot and Ankle Research* 3 (2010): 15.
3. A Aquino and C Payne. "Function of the plantar fascia". *The Foot* 9.2 (1999): 73-78.
4. HICKS JH. "The mechanics of the foot. II. The plantar aponeurosis and the arch". *Journal of Anatomy* 88.1 (1954): 25-30.
5. Cutts S., et al. "Plantar fasciitis". *Annals of The Royal College of Surgeons of England* 94.8 (2012): 539-542.
6. Mischke JJ., et al. "The symptomatic and functional effects of manual physical therapy on plantar heel pain: a systematic review". *Journal of Manual and Manipulative Therapy* 25.1 (2017): 3-10.
7. Crawford F., et al. "Interventions for treating plantar heel pain". *Cochrane Database System Reviews* 3 (2000): CD000416.
8. Tahririan M A., et al. "Plantar fasciitis". *Journal of Research in Medical Sciences : The Official Journal of Isfahan University of Medical Sciences* 17.8 (2012): 799-804.
9. Tanz SS. "Heel pain". *Clinical Orthopaedics and Related Research* 28 (1963): 169-178.
10. Shmokler RL., et al. "A new use of instrumentation in fluoroscopy controlled heel spur surgery". *Journal of the American Podiatric Medical Association* 78.4 (1988): 194-197.
11. Tezel N., et al. "Short-term efficacy of kinesiotaping versus extracorporeal shockwave therapy for plantar fasciitis: A randomized study". *Saudi Medical Journal* 8 (2020): 181-187.
12. Chimutengwende-Gordon M., et al. "Magnetic resonance imaging in plantar heel pain". *Foot and Ankle International* 31.10 (2010): 865-870.
13. Alshami AM., et al. "Biomechanical evaluation of two clinical tests for plantar heel pain: the dorsiflexion-eversion test for tarsal tunnel syndrome and the windlass test for plantar fasciitis". *Foot Ankle International* 28 (2007): 499- 505.
14. De Garceau D., et al. "The association between diagnosis of plantar fasciitis and Windlass test results". *Foot Ankle International* 24.3 (2003): 251-255.
15. Kapoor A., et al. "Realtime elastography in plantar fasciitis: comparison with ultrasonography and MRI". *Current Orthopaedic Practice* 21.6 (2010): 600-608.
16. Groshar D., et al. "Plantar fasciitis: detection with ultrasonography versus bone scintigraphy". *Journal of Foot* 10.3 (2000): 164-168.
17. Fabrikant J and Park T. "Plantar fasciitis (fasciosis) treatment outcome study: Plantar fascia thickness measured by ultrasound and correlated with patient self-reported improvement". *The Foot* 21.2 (2011): 79-83.

18. McMillan AM., *et al.* "Ultrasound guided injection of dexamethasone versus placebo for treatment of plantar fasciitis: protocol for a randomised controlled trial". *Journal of Foot and Ankle Research* 16.3 (2010).
19. Tong KB and Furia J. "Economic burden of plantar fasciitis treatment in the United States". *American Journal of Orthopaedics (Belle Mead, N.J.)*. 39.5 (2010): 227-231.
20. Buchbinder R. "Clinical practice. Plantar fasciitis". *The New England Journal of Medicine* 350.21 (2004): 2159-2166.
21. Abdel-Wahab N., *et al.* "High-resolution ultrasonographic diagnosis of plantar fasciitis: A correlation of ultrasound and magnetic resonance imaging". *International Journal of Rheumatic Diseases* 11 (2008): 279-286.
22. Association APT. "Vision statement for the physical therapy profession and guiding principles to achieve the vision" (2014).
23. Sabir N., *et al.* "Clinical utility of sonography in diagnosing plantar fasciitis". *Journal of Ultrasound Medicine* 24.8 (2005): 1041-1048.
24. Wu CH., *et al.* "Can sonoelastography detect plantar fasciitis earlier than traditional B-mode ultrasonography?" *American Journal of Physical Medicine and Rehabilitation* 91.2 (2012): 185.