



CORRELATION OF BODY MASS INDEX WITH THICKNESS OF THE PLANTAR FASCIA AND HEEL PAD FAT IN ASYMPTOMATIC AND SYMPTOMATIC PARTICIPANTS WITH HEEL PAIN

Orthopaedics

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ABSTRACT

Introduction: Obese people are at risk of Plantar fasciitis due to increased pressure on plantar fascia. Mechanical changes in plantar fascia is surely associated with obesity. With this objective present study was undertaken to evaluate USG findings of plantar fascia and heel pad thickness (HPT) amongst asymptomatic and symptomatic cases of heel pain. **Material And Method:** 25 patients with symptom of heel pain and 25 healthy participants without heel pain between age 18 to 60 years were enrolled. Ultrasonography (USG) was performed in all participants (N=50) and plantar fascial thickness & heel pad thickness were assessed. **Result:** Mean age in cases were 38.96 ± 5.97 and in controls were 41 ± 7.18 . Mean BMI in cases were 28.64 ± 2.98 and in controls were 20.92 ± 1.07 . PFT (mm) mean in cases on right side were 3.46 ± 0.92 and on left side were 3.51 ± 0.73 . In controls on right side were 2.96 ± 0.47 and on left side were 2.9 ± 0.52 . (p value Right 0.02 Left 0.001). HPT (mm) mean in cases on right side were 22.256 ± 2.77 and on left side were 21.96 ± 2.77 . In controls on right side were 19.1 ± 4.03 and on left side were 19.32 ± 5.37 . (p value Right 0.002 Left 0.034). **Discussion:** Body mass index (BMI) was higher in the cases compared to control group in our study suggesting that obesity may be a factor predisposing to heel pain by exerting excessive stress on the plantar fascia. **Conclusion:** There is significant correlation (p < 0.05) observed between plantar fascial thickness, heel pad thickness (HPT) and BMI.

KEYWORDS

PFT, HPT

INTRODUCTION

The plantar fascia is a thick, web-like fibrous aponeurosis that connects heel originating on the plantar surface of the posteromedial calcaneal tuberosity up to the front of foot. It acts as a shock absorber and supports the arch of your foot, helping you walk^{1,2}. Plantar fasciitis is one of the most common orthopaedic complaints where plantar fascia becomes inflamed as ligament experiences a lot of wear and tear due to too much pressure on feet which causes heel pain and stiffness³. Overweight or obese people are at risk due to increased pressure on plantar fascia ligaments, especially when there is sudden weight gain.

Heel pad is a thick layer of tissue present on soles of feet made up of dense fat pockets surrounded by tough and stretchy muscle fibres. During walking, running or jumping it act as a cushion distributing body weight and absorbing shock to protect bones and joints. Carrying extra body weight may put additional stress on it resulting in its break down. Hence Overweight or obese people are at risk.

Diagnosis of plantar fasciitis contains clinical examination with tenderness, reflexes, muscle tone and coordination with x ray & MRI advised further⁴. However high-resolution ultrasonography has been proven to be a valuable technique for the diagnosis of plantar fasciitis because of its accuracy and effectiveness in morphological assessment in plantar fasciitis as compared to MRI⁵. Additional advantage is it is non-invasiveness, relatively inexpensive, well tolerated by patient and having excellent spatial resolution⁶.

Previous studies have done to find correlation between plantar fasciitis, heel pad thickness (HPT) and body mass index (BMI) in Overweight or obese people⁷. Some studies have found that heel pad thickness (HPT) is increased whereas some found it is atrophied⁸. However high incidence of these mechanical changes in overweight and obese individuals is surely associated with plantar fasciitis and heel pad thickness (HPT). With this objective present study was undertaken to evaluate USG findings of plantar fascia and heel pad thickness (HPT) amongst asymptomatic and symptomatic cases of heel pain

MATERIALS AND METHODS

Present study is a case controlled cross sectional prospective study conducted in the department of orthopaedics in collaboration with Department of Radiology, MGM Hospital, Aurangabad from January to May 2021. Approval of institutional ethics committee was taken prior to commencement of this study. All the participants were provided written consent form and their signatures were obtained before the start of study.

Inclusion Criteria

1. 25 participants between age 18 to 60 years of both sexes with heel pain (**Cases**)
2. 25 participants between age 18 to 60 years of both sexes without heel pain (**Controls**)

Exclusion Criteria

Patients who had heel pain other than of plantar fasciitis like trauma, postsurgical or arthritis

Procedure

25 patients with symptom of heel pain suggesting plantar fasciitis attending outpatient department (OPD) under department of Orthopaedics were clinically examined first for Soft tissue and bone abnormalities of the foot. Lateral X ray of foot was performed to check for subcalcaneal bony spur. 25 healthy control subjects of age and gender matched with no symptom of heel pain were selected from general population. Weight and height were recorded from all 50 participants and BMI was calculated by using the standard formula i.e. $BMI = \text{Weight (Kg)} / \text{Height (m)}^2$. Ultrasonography (USG) in B-mode (resolution 10 MHz) was performed in all participants (N=50) in prone position with feet hanging over the edge of the examination table for stretching the plantar fascia which will better delineate its margins. In Ultrasonography (USG) plantar fascial thickness and heel pad thickness were evaluated. Data obtained were compiled and analysed by standard statistical analytical tools using SPSS 11.5 Software.

RESULTS

Table 1: Age And Sex Distribution

Sr No.	Age	Controls		Cases		Total
		Male N	Female N	Male N	Female N	
1	18 to 30	2	1	1	0	4
2	31 to 40	5	4	7	7	23
3	41 to 50	6	7	7	3	23
4	> 50	0	0	0	0	0
Total		13	12	15	10	50 (100 %)

Table 1 shows Age and Sex distribution amongst study participants. It shows that the occurrence of plantar fasciitis is more common in middle aged group between 31 to 50 years (24 out of 25 patients). 14 males and 10 females. Healthy volunteers in control group also shows similar pattern of age and sex distribution with most common age range being 31 to 50 years.

Table 2: Demographic Variables Distribution

Sr No.	Demographic Variable	Controls Mean $\pm$ SD	Cases Mean $\pm$ SD	P Value
1	Age	41 ± 7.18	38.96 ± 5.97	0.28
2	Height	165.12 ± 5.64	164.98 ± 4.41	0.92

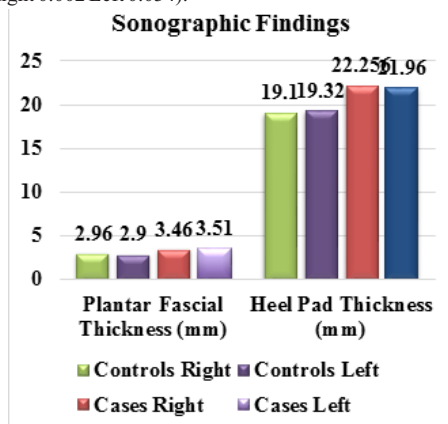
3	Weight	57.44 ± 4.92	77.96 ± 8.48	<0.0001
4	BMI	20.92 ± 1.07	28.64 ± 2.98	<0.0001

Table 2 shows demographic Variables distribution amongst study participants. Mean age in cases were 38.96 ± 5.97 and in controls were 41 ± 7.18 (p=0.28). Mean height in cases were 164.98 ± 4.41 and in controls were 165.12 ± 5.64 (p=0.92). Mean weight in cases were 77.96 ± 8.48 and in controls were 57.44 ± 4.92 (p<0.0001). Mean BMI in cases were 28.64 ± 2.98 and in controls were 20.92 ± 1.07 (p<0.0001)

Table 3: Sonographic Findings Distribution

Sr No.	Sonographic Findings	Controls Mean ± SD		Cases Mean ± SD		P Value
		Right	Left	Right	Left	
1	Plantar Fascial Thickness (mm)	2.96 ± 0.47	2.9 ± 0.52	3.46 ± 0.92	3.51 ± 0.73	Right 0.02 Left 0.001
2	Heel Pad Thickness (mm)	19.1 ± 4.03	19.32 ± 5.37	22.256 ± 2.77	21.96 ± 2.77	Right 0.002 Left 0.034

Table 3 shows Sonographic Findings distribution amongst study participants. Plantar Fascial Thickness (mm) mean in cases on right side were 3.46 ± 0.92 and on left side were 3.51 ± 0.73. Plantar Fascial Thickness (mm) mean in controls on right side were 2.96 ± 0.47 and on left side were 2.9 ± 0.52. (p value Right 0.02 Left 0.001). Heel Pad Thickness (mm) mean in cases on right side were 22.256 ± 2.77 and on left side were 21.96 ± 2.77. Heel Pad Thickness (mm) mean in controls on right side were 19.1 ± 4.03 and on left side were 19.32 ± 5.37. (p value Right 0.002 Left 0.034).



Graph 1: Sonographic Findings distribution

DISCUSSION

Repetitive cumulative microtrauma due to overuse as well as cumulative overload is often associated with plantar heel pain and suggesting major contributing factor in its development. Plantar fascia is the most important structure for dynamic arch support. Thickness of the heel is an important factor in determining the stress at tissues. Factors such as weight, age and gender may individually contribute to variability in heel pad thickness. Previous studies have reported that degeneration in fibrous structures and fat in heel pad may be associated with either ageing or obesity⁹.

In the present study maximum incidence of cases was found in middle aged group between 31 to 50 years (96 %) and in males (56 %). Similar result was found in study by Barrett SJ et al⁶. In our study Plantar Fascial Thickness (mm) in cases on right side were 3.46 ± 0.92 and in controls were 2.96 ± 0.47. These correlations were statistically significant (p value 0.02). On left side it was 3.51 ± 0.73 in cases and 2.9 ± 0.52 in controls. (p value 0.001). Heel Pad Thickness (mm) in cases on right side were 22.256 ± 2.77 and in controls were 19.1 ± 4.03 (p value Right 0.002). On left side were 21.96 ± 2.77 in cases and 19.32 ± 5.37 in controls. (p value 0.034). Similar results were found by Gibbon W et al¹⁰ with mean PF thickness was reported as 3.3 mm (2.4 to 4.3 mm). Cardinal et al¹¹ found mean PF thickness as 2.6 mm (1.6 to 3.8 mm). Wall et al¹² found mean PF thickness as 3.4 mm for females and 3.6 mm for males.

Body weight has been found as an important contributing factor in plantar heel pain. Body mass index (BMI) was higher in the cases compared to control group in our study suggesting that obesity may be a factor predisposing to heel pain by exerting excessive stress on the

plantar fascia. Our results are consistent with other studies which also reported a relationship between BMI and heel pad^{13,14}. Amis et al¹⁵ have reported a significant increase in heel pad thickness (HPT) in patients with higher BMI. Similar results were shown by Prichasuk S et al¹⁶ who found that the heel-pad thickness and compressibility index (resistance to compression) were greater in the patient groups. Excessive microtrauma from excessive overload might be associated with structural changes (model of fatigue adaptation) and inflammatory oedema which has caused a thicker heel pad and pain. The thicker heel pad in the case group may represent the accumulation of repetitive microtrauma and resultant painful inflammation

CONCLUSION

Ultrasonography (USG) is an important tool for the evaluation of heel pain, because of its easy availability, quick performance, high sensitivity of diagnosis, low-cost and free of radiation. Increased plantar fascia thickness and heel pain thickness (HPT) are chief sonographic findings in patients with heel pain due to plantar fasciitis. There is significant correlation (p <0.05) observed between plantar fascial thickness, heel pad thickness (HPT) and BMI. Clinicians should be aware that thicker heel pads might be a contributing factor in the development of heel pain and its management plans should take the note of the heel pad in the aetiology.

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