Section: Orthopedics

Original Research Article

ASSOCIATION OF HYPOTHYROIDISM AND DYSLIPIDEMIAS WITH PLANTAR FASCIITIS IN NORTH INDIAN POPULATION

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ABSTRACT

Background: Millions of individuals are affected by plantar fasciitis, yet the understanding of all the factors contributing to this condition remains inadequate. This painful and often chronic condition is caused by inflammation of the plantar fascia, a thick band of tissue that runs along the bottom of the foot. This condition can negatively affect walking, running, and other forms of physical activity. **Materials and Methods:** A total of 40 patients diagnosed with plantar fasciitis, who reported heel discomfort and were aged between 25 and 60, were included in this study. The group with plantar fasciitis in this case-control study comprised 40 patients with an average age of 36.8 years. **Result:** The average TSH level for patients with plantar fasciitis was 5.42 mIU/ml, which was higher than the control group's average of 1.26 mIU/ml ($p<0.02$). The mean TC level of patients was 198.26 mg/dl, which was higher than the control group's mean of 187.64 mg/dl. Hypercholesterolemia was found in 18% of patients (7 cases) and in 5% (2 controls) of our control group. Patients exhibited significantly elevated levels of triglycerides ($p<0.02$), LDL-c ($p<0.02$), and VLDL-c ($p<0.04$) compared to controls. In patients, HDL levels were significantly lower than in controls ($p<0.04$). **Conclusion:** The Indian population suffering from plantar fasciitis exhibited considerably elevated levels of TSH, serum cholesterol, serum triglycerides, serum LDL, and serum VLDL, along with low HDL levels. Therefore, when treating plantar fasciitis, it is important to assess hypothyroidism and dyslipidemias.

INTRODUCTION

Plantar fasciitis is a prevalent, crippling disease that affects millions of individuals worldwide.[1] This painful and often chronic condition is brought on by inflammation of the plantar fascia, a thick band of tissue that runs around the bottom of the foot. This disorder can negatively affect physical activity such as walking, running, and other physical activities. Despite its prevalence, the specific etiology of plantar fasciitis is still unknown.[2] The most common cause of plantar fasciitis is overuse stress, while the ailment can also result from other factors. Regarding pathogenicity, it is well recognized that metabolic disorders produce complex biomechanical structures that alter the conformation and mechanical characteristics of tendons, especially in the Achilles tendon, plantar fascia, and metatarsophalangeal joints.[3] Studies have indicated a possible connection between metabolic disorders like diabetes, obesity, and metabolic syndrome and plantar fasciitis.[4] The reason for this could be that metabolic disorders can alter the body's inflammatory response, which can make the plantar fascia more inflamed. Plantar fasciitis may also develop as a result of increased mechanical stress on the plantar fascia brought on by variables including weight gain and changes in stride linked to metabolic disorders. Although runners and older persons are often linked to the illness, other risk factors include age, obesity, heel pad atrophy, and jobs requiring extended standing.[5] It is evident that there is a complex interaction between plantar fasciitis and metabolic illnesses that requires greater research, even though the exact nature of this association is yet unknown. Despite the high prevalence of this illness in the Indian community, little is known about plantar fasciitis in Indian

patients. It is important to remember that cultural variables, such wearing traditional shoes or engaging in specific job-related activities, may also play a role in the development of plantar fasciitis in Indian patients. Hyperlipidemia has already been linked to plantar fasciitis in a number of studies.[6] To the best of our knowledge, there is no recorded evidence that hypothyroidism and plantar fasciitis are related. This study assesses the connection between hyperlipdemia and thyroid conditions in Indian individuals. Thyroid hormones are involved in controlling the body's metabolic processes, which can affect the health of connective tissues like the plantar fascia. Moreover, those suffering from hypothyroidism might notice alterations in their walking pattern or an increase in weight—either of which can lead to the onset of plantar fasciitis. There has also been a link established between plantar fasciitis and hyperlipidemia, a condition characterized by elevated levels of blood lipids.[7] Studies have indicated that people who have hyperlipidemia may have a higher propensity for developing plantar fasciitis, and that in these individuals the condition may be more acute. This might be because hyperlipidemia can alter the body's inflammatory response, potentially worsening the inflammation of the plantar fascia. Furthermore, hyperlipidemia may result in the accumulation of cholesterol and fatty acids in the blood vessels that nourish the plantar fascia. This can diminish blood circulation and promote the onset of plantar fasciitis. We assessed the levels of thyroid profile, liver profile, renal profile, and lipid profile in our patients and aimed to determine if this relationship exists within the North Indian population.

MATERIALS AND METHODS

This present study was carried in the department of Orthopedics, World College of Medical Sciences Research and Hospital, Jhajjar during the period from March, 2022 to December, 2023. This study enrolled a total of 40 patients (23 males and 17 females) diagnosed with plantar fasciitis, who experienced heel discomfort and were aged between 25 and 60. Diagnosis of plantar fasciitis was based on the patient's history, presence of morning/start-up pain, and finding of localized tenderness in the medial calcaneal tubercle. Patients with other systemic or local causes of heel pain, such as pes planus or pes cavus, inflammatory diseases, neuromuscular disorders, or prior hind foot surgery, were excluded. The plantar fasciitis group in this case-control study comprised 40 patients (22 males and 18 females), with an average age of 36.8 years. The control group consisted of patients who visited the orthopedics outpatient department with complaints not related to heel pain. The control group consisted of 40 patients, whose average age was 34.26 years. The study excluded patients who had already been diagnosed and were receiving treatment for conditions such as diabetes, hypertension, thyroid disorders, hypercholesterolemia, and renal disorders. Blood samples were drawn from the patients for thyroid profile (T3, T4, TSH), liver profile (Bilirubin, SGOT, SGPT), renal profile (Serum creatinine, urea & uric acid), and lipid profile (serum total cholesterol (TC), triglyceride LDL, HDL & VLDL) levels. All blood samples were gathered in the morning after participants had fasted overnight. Patients with abnormal laboratory values were notified of their results and advised to consult a physician for appropriate treatment.

The data obtained was entered into Microsoft Excel spreadsheet and data was analysed using SPSS for Windows version 20. The categorical data was expressed in terms of rates, ratios and percentages and the continuous data was expressed in terms of Mean ± Standard Deviation. A probability (p) value of ≤0.05 was considered as statistically significant.

RESULTS

A total of 40 patients (23 males and 17 females) diagnosed with plantar fasciitis, who reported heel discomfort and were aged between 25 and 60, were included in this study. The group with plantar fasciitis in this case-control study comprised 40 patients (22 males and 18 females), as shown in [Figure 1], with an average age of 36.8 years. The average TSH level for patients with plantar fasciitis was 5.42 mIU/ml, which was higher than the control group's average of 1.26 mIU/ml ($p<0.02$). In our patient cohort, hypothyroidism was identified in 28% (11 cases), whereas in the control group, it occurred in 8% (3 cases).

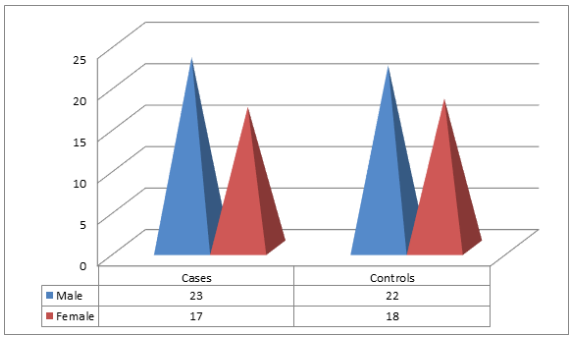

Figure 1: Shows the no. of subjects according to gender.

Compared to the control group, patients with plantar fasciitis had a significantly elevated serum cholesterol level ($p=0.03$). The mean TC level of patients was 198.26 mg/dl, which was higher than the control group's mean of 187.64 mg/dl. Hypercholesterolemia was found in 18% of patients (7 cases) and in 5% (2 controls) of our control group. Patients exhibited significantly elevated levels of triglycerides ($p<0.02$), LDL-c ($p<0.02$), and VLDL-c ($p<0.04$) compared to controls. In

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patients, HDL levels were significantly lower than in controls ($p<0.04$). No significant differences were observed between the two groups regarding the T3 level, T4 level, total bilirubin, SGOT, SGPT, serum creatine, urea, and serum uric acid levels [Table1].

Table 1: Shows the comparison of biochemical parameters between cases and controls.

Biochemical Parameters	Cases(mean ±SD)	Controls(mean ±SD)	P value
T. cholesterol (mg/dl)	198.26± 27.36	187.64± 25.67	0.03
Triglycerides (mg/dl)	182.06± 24.62	152.36±20.34	0.02
HDL-c (mg/dl)	44.21± 9.64	47.65± 9.86	0.04
LDL-c (mg/dl)	98.46± 14.65	74.36± 11.32	0.02
VLDL-c (mg/dl)	28.36± 8.62	26.52± 5.32	0.04
Urea (mg/dl)	26.62± 7.04	25.48± 6.12	0.16
Creatinine (mg/dl)	0.76± 0.02	0.64± 0.01	0.46
Uric acid (mg/dl)	4.21± 1.06	3.31± 0.52	0.07
T. bilirubin (mg/dl)	0.98± 0.02	0.86± 0.01	0.32
SGOT (IU/L)	22.06± 5.21	26.36± 5.34	0.04
SGPT (IU/L)	28.54± 6.12	34.5± 7.4	0.26
TSH (µIU/ml)	5.42± 1.02	1.26± 0.24	0.02
T3 (ng/ml)	1.82± 0.04	1.24± 0.02	0.90
T4 (µg/ml)	10.26± 1.12	6.88± 1.06	0.38

DISCUSSION

The genesis of plantar fasciitis is not completely understood, and there are many possible factors that may contribute to its pathophysiology. This is, to the best of our knowledge and as previously noted, the first study to directly examine the link between hypothyroidism and plantar fasciitis. It is thought that hypothyroidism is a widespread health problem in India, impacting about one out of every 10 adults.[8] Hypothyroidism can present in various forms, from overt myxedema, end-organ consequences, and multisystem failure to asymptomatic or subclinical cases, even when serum thyrotropin levels are moderately elevated and thyroxine and triiodothyronine levels are within the normal range.[9] Research has shown that hypothyroidism leads to hypoxia and apoptosis, both of which contribute to musculoskeletal problems in humans.[10] A surface receptor for thyroid hormones has been identified on a structural protein of the plasma membrane found in nearly all cells, triggering cellular responses such as proliferation and angiogenesis. This receptor is associated with the role of the ECM in thyroid activities.[11] It seems that the process of angiogenesis is closely linked to the activation of basic fibroblast growth factors and VEGFs, which assist in the formation of vascular structures.[12] Tendinopathies seem to be linked with factors such as incomplete vascularization, tissue hypoxia, the involvement of reactive oxygen species, and apoptosis.[13] Research has demonstrated a connection between thyroid pathologies and non-traumatic rotator cuff tears.[14] One hypothesis regarding the origins of calcific tendinopathies suggests that metaplasia and calcium deposition occur due to a decrease in oxygenation of the rotator cuff tendons associated with hypothyroidism.[15] Thus, both tendinopathies and tendon injuries involve hypothyroidism as a contributing factor, which also affects the healing process. Our study found that 8 percent of individuals in the control population were diagnosed with hypothyroidism, reflecting the prevalence seen in the Indian population.[11] In patients, hypothyroidism occurred significantly more often than in controls ($p<0.02$). In cases of plantar fasciitis, patients should utilize this correlation to eliminate the possibility of thyroid disorders. It also stresses the importance of starting appropriate medical therapy, as plantar fasciitis treatment involves more than just mechanical intervention. Some studies investigate the impact of high cholesterol on the musculoskeletal system.[16]Ozgurtas et al. found that 74% of patients with an Achilles tendon rupture had hypercholesterolemia.[17] Abboud et al. reported that patients with rotator cuff tears had significantly higher levels of TC, LDL-C, and TG compared to those with normal rotator cuff tendons.[18] The accumulation of cholesterol in tendons seems to lead to a moderate and chronic inflammation and may change the extracellular matrix of the fascia and tendons.[19] This results in chronic degeneration of the tendon and alterations to its biomechanics. Metabolic parameters may worsen due to the limitation of physical activity caused by plantar fasciitis.[20]

It was discovered that hypercholesterolemia may induce changes in the microenvironments of tendons due to localized modifications in protein synthesis and the turnover of extracellular matrix components. It has been shown that hypercholesterolemia modifies gene expression, resulting in heightened inflammatory activity and cytokine production within the tendon microenvironment.[21] The biomechanical properties of the tendons degrade, which is another effect of hypercholesterolemia. A study found that hypercholesterolemia increased the stiffness of the supraspinatus tendon.[22] A systematic review found that individuals with modified tendon structure exhibited elevated levels of TC, LDL-C, and TG, along with a reduced HDL-C level, in comparison to those documented for

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healthy adults.[23]Außerdemwurdegezeigt, dasseineUmgebungmithohemCholesterinspiegel negative Auswirkungen auf die Sehnenheilung hat.[24] In a comparable way, elevated cholesterol levels can contribute to the onset of plantar fasciitis by hindering the healing and regenerative processes of the plantar fascia. This study found that serum cholesterol levels were significantly elevated in patients with plantar fasciitis compared to the control group (p=0.03), which aligns with results from other research. This study aims to enhance the awareness of this association among patients and physicians, facilitating early detection of lipid and cholesterol disorders and thereby preventing other systemic diseases linked to these conditions. A limitation of the study was the lack of consideration for how long the enrolled patients had experienced symptoms. It should be investigated in a separate study whether this has any impact on our results. The study included 40 patients and 40 controls. Having more subjects in both groups would enhance understanding and allow the results to be applied to the general population.

CONCLUSION

To sum up, patients with plantar fasciitis exhibited markedly elevated TSH levels, demonstrating that it is a risk factor. The study observed significantly elevated levels of serum cholesterol, triglycerides, LDL, VLDL, and low HDL, which aligns with findings from other research. This indicates that the Indian population also demonstrates a correlation between dyslipidemias and plantar fasciitis.

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