

Original Article

Association of Isolated Gastrocnemius Tightness in Patients with Heel Pain

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ABSTRACT

Background: Heel pain is a common musculoskeletal complaint among adults, significantly impacting quality of life. Recent studies suggest a strong association between isolated gastrocnemius tightness and heel pain, although comprehensive research in diverse populations remains scarce. Understanding the relationship between gastrocnemius tightness and heel pain is crucial for developing effective treatment strategies.

Objective: This study aimed to investigate the association of isolated gastrocnemius tightness with heel pain in a Pakistani adult population, focusing on the prevalence of gastrocnemius tightness among individuals presenting with heel pain and the effectiveness of specific diagnostic tests in identifying this condition.

Methods: A prospective cross-sectional study was conducted involving 223 participants from various hospitals in Lahore, Pakistan. The study population comprised adults aged 30 to 60 years experiencing heel pain. Diagnostic assessments included the Windlass and Silfverskiöld tests to evaluate plantar fasciitis and gastrocnemius tightness, respectively. Data on age, gender, and test outcomes were collected and analyzed using SPSS version 25.0, employing descriptive statistics, Pearson's correlation, and significance testing to explore the association between heel pain and gastrocnemius tightness.

Results: The average age of participants was 42.24 ± 4.973 years, with a gender distribution of 59.6% females and 40.4% males. The Windlass test was positive in 89.2% (199) of participants, while the Silfverskiöld test showed a positive outcome for gastrocnemius tightness in 79.8% (178) of cases. A significant correlation was found between the results of the Windlass and Silfverskiöld tests (Pearson correlation = .691, $p < .000$), indicating a strong association between isolated gastrocnemius tightness and heel pain.

Conclusion: This study confirms a significant association between isolated gastrocnemius tightness and heel pain among adults in Lahore, Pakistan. The findings underscore the importance of assessing gastrocnemius tightness in patients presenting with heel pain and suggest that targeted interventions addressing this condition could enhance treatment outcomes.

Keywords: Heel pain, Gastrocnemius tightness, Windlass test, Silfverskiöld test, Plantar fasciitis, Musculoskeletal disorders.

INTRODUCTION

Heel pain represents a significant musculoskeletal concern, predominantly observed among adults and the elderly. This condition encompasses various diagnoses including plantar fasciitis, often colloquially referred to as jogger's, tennis, or policeman's heel (1, 2). The prevalence of heel pain is reported to range between 5.2% and 17.5%, with a higher incidence in middle-aged to older adults. Traditionally termed plantar fasciitis, recent research challenges the notion of inflammation in favor of microtears within the plantar fascia due to repetitive stress (3, 4). This leads to the degradation of collagen fibers, affecting not only the fascia but surrounding structures as well. Consequently, the terminology has evolved to include plantar fasciopathy, fasciosis, and more generically, plantar heel pain, to reflect the pathology more accurately (4, 5).

Heel pain is characterized by discomfort exacerbated by weight-bearing activities, with common etiologies including gastrocnemius muscle tightness, plantar fasciitis, fat pad atrophy, and calcaneal stress fractures. Predisposing factors encompass a range of conditions from obesity, prolonged standing, sedentary lifestyle, inappropriate footwear, to anatomical variations like pes planus or

cavus, limited ankle dorsiflexion, and abnormal foot mechanics. Such factors contribute to increased strain at the plantar fascia origin, leading to its degeneration (5, 6).

The gastrocnemius muscle, a crucial component of the triceps surae, plays a significant role in ankle plantarflexion, contributing to 40-60% of the force. Tightness in the gastrocnemius can lead to increased forefoot pressures and symptomatic heel pain, even without significant dorsiflexion limitation. This is because tightness in this muscle can alter gait and increase the load on the plantar fascia. Clinical examination typically reveals pain on the first steps in the morning or after periods of rest, localized tenderness on the anteromedial side of the heel, and reduced ankle dorsiflexion (3, 6).

Diagnostic approaches for gastrocnemius tightness and plantar heel pain include the Silfverskiöld test, which assesses the difference in ankle dorsiflexion with the knee flexed and extended, and the Windlass test for plantar fasciitis. Treatment modalities range from conservative measures like activity modification, stretching exercises, and orthotics, to surgical interventions such as gastrocnemius release in refractory cases (5, 7).

Despite the prevalence and impact of heel pain, research in regions like Pakistan on the association between gastrocnemius tightness and heel pain remains limited. This study aims to elucidate the correlation between isolated gastrocnemius tightness and heel pain, enhancing the understanding of this condition among healthcare providers. The evidence suggests a strong association between gastrocnemius tightness and heel pain severity, with stretching exercises for the gastrocnemius muscle demonstrating efficacy in alleviating symptoms of plantar fasciitis. This underscores the importance of recognizing and addressing gastrocnemius tightness in patients presenting with heel pain, to optimize treatment outcomes and improve quality of life (8-10).

MATERIAL AND METHODS

The research was conducted within the confines of the physical therapy and orthopedic departments across several prominent hospitals in Lahore, including Fatima Memorial Hospital, Sheikh Zayed Hospital, General Hospital, CMH, Lahore Medical and Dental College, Gurki Hospital, National Hospital, Government Samanabad Hospital, Haq Orthopaedic Hospital, Mid City Hospital, Services Hospital, and Mayo Hospital. The focus was on patients presenting with heel pain, a prevalent complaint within these departments (11, 12).

To determine the required sample size, the study utilized G*Power software version 3.1.7, employing a formula designed for estimating proportions. With a confidence level set at 95% ($Z\alpha=1.96$), an expected proportion (P) of 92%, and a margin of error (d) of 5%, the calculation yielded a minimum required sample size of 223 participants. This study targeted individuals aged between 30 to 60 years, who were engaged in occupations that necessitated prolonged standing periods, such as teaching, security, legal professions, and homemaking. Exclusion criteria were strictly adhered to, disqualifying individuals with recent infections, trauma, other foot and ankle pathologies, or those who had undergone recent surgeries on the ankle or foot (8-12).

The study was designed as an observational, cross-sectional analysis, spanning approximately five to six months following the approval of its synopsis. Data collection hinged on the administration of the Silfverskiöld and Windlass tests, chosen for their relevance to the investigation of gastrocnemius tightness and heel pain, respectively. Prior to commencing data collection, necessary permissions were obtained from the university. The recruitment process involved selecting patients from the departments who demonstrated positive results in special tests for heel pain. Participants were fully briefed on the research's aims and procedures, with their consent obtained before proceeding. Each participant underwent a thorough interview, followed by the demonstration and execution of the Windlass and Silfverskiöld tests. Those exhibiting positive Windlass test results for heel pain were subsequently assessed for gastrocnemius tightness using the Silfverskiöld test (13).

For data analysis, the Statistical Package for the Social Sciences (SPSS) version 25.0 was utilized. The analysis included descriptive statistics to outline participant demographics, employing percentages and frequencies. Categorical data were visually represented through pie charts and bar graphs, while Pearson's correlation coefficient was calculated to explore the relationship between heel pain and isolated gastrocnemius tightness.

Ethical considerations were paramount throughout the study, adhering to the guidelines established by the Declaration of Helsinki of 1964. The Offices of Research, Innovation, and Commercialization (ORIC) ensured participants were fully informed about the study's nature and their involvement in it. Participation was voluntary, with assurances that individuals could withdraw at any time without repercussions. The study emphasized the importance of avoiding physical, psychological, or emotional harm to the participants. Confidentiality was rigorously maintained, with all personal information securely protected. The study made clear that any breach of ethical standards would grant ORIC the authority to revoke the study's approval.

RESULTS

The study involved a total of 223 participants, with an average age of 42.24 years and a standard deviation of 4.973, indicating a middle-aged cohort reflective of the general adult population likely to experience heel pain, a condition uniformly present across the sample (Table 1). This demographic makeup underscores the relevance of the research to a broad spectrum of individuals within the specified age range.

Gender distribution within the study showed a higher prevalence of female participants, who constituted 59.6% (133 individuals), compared to male participants, who made up 40.4% (90 individuals). This gender distribution is particularly significant as it may reflect gender-specific predispositions to heel pain or differences in healthcare-seeking behavior between genders (Table 2).

The Windlass Test, utilized to diagnose plantar fasciitis, yielded a positive result in 89.2% (199 individuals) of the cases, suggesting a high prevalence of this condition among the participants. Conversely, the negative outcomes were observed in 10.8% (24 individuals), indicating a lesser but significant portion of the population not exhibiting the typical mechanical response associated with plantar fasciitis (Table 2).

Similarly, the Silfverskiöld Test, which assesses gastrocnemius tightness, showed positive results in 79.8% (178 individuals) of the participants. This high percentage underscores the commonality of gastrocnemius tightness in individuals suffering from heel pain, with only 9.4% (21 individuals) testing negative for this condition (Table 2).

Table 1 Descriptive Statistics

Variable	N	Mean	Std. Deviation
Age of participants	223	42.24	4.973
Heel pain	223	1.00	0.000

Table 2 Demographic and Study Characteristics

Variable	Gender / Test Outcome	Frequency	Percentage (%)
Gender	Male	90	40.4
	Female	133	59.6
Windlass Test	Positive	199	89.2
	Negative	24	10.8
Silfverskiöld Test	Positive	178	79.8
	Negative	21	9.4

Table 3 Correlation Between Isolated Gastrocnemius Tightness in Patients with Heel Pain

	Windlass Test	Silfverskiöld Test
Windlass Test	Pearson Correlation: 1	Pearson Correlation: .691
	Sig. (2-tailed): .000	Sig. (2-tailed): .000
	N: 223	N: 223
Silfverskiöld Test	Pearson Correlation: .691	Pearson Correlation: 1
	Sig. (2-tailed): .000	Sig. (2-tailed): .000
	N: 223	N: 223

The correlation analysis between the Windlass and Silfverskiöld tests revealed a statistically significant relationship, with a Pearson Correlation coefficient of .691. This strong positive correlation, significant at the .000 level, demonstrates a substantial association between isolated gastrocnemius tightness and the presence of heel pain, as indicated by the Windlass test outcomes. The sample size of 223 for both tests solidifies the robustness of this finding, suggesting that interventions targeting gastrocnemius tightness may be beneficial in managing heel pain in this population (Table 3).

DISCUSSION

This research delved into the association between isolated gastrocnemius tightness and heel pain, revealing a significant correlation that supports the hypothesis that gastrocnemius tightness contributes to heel pain symptoms. The study's population, averaging 42.24 years in age with a standard deviation of 4.973, reflects findings similar to those of CJ Pearce et al., where participants had a mean age of 44, underscoring the prevalence of heel pain within the middle-aged demographic. Notably, the gender distribution

among participants—133 females and 90 males—enhanced the diversity and comprehensiveness of the research, offering insights into the condition's impact across genders (14-16).

The alignment of this study's outcomes with those of Mohamed et al., Molund, Pearce et al., Pickin et al., further solidifies the link between gastrocnemius tightness and heel pain. Particularly, Hafeez et al. emphasized the correlation between tight posterior calf muscles and increased pain during initial weight-bearing activities in the morning, a finding echoed by our research which identified a high percentage of participants with limited ankle dorsiflexion and subsequent heel pain (17-20).

Addressing the limitations encountered in prior studies, this research carefully considered age groups and ensured balanced gender representation. By adopting a prospective cross-sectional approach and utilizing specific diagnostic tests, such as the windlass and Silfverskiöld tests, the study aimed to mitigate information bias, enhancing the validity of its findings. The windlass test, pivotal in diagnosing plantar fasciitis, showed a high positivity rate among participants, corroborating the test's effectiveness as highlighted by Primadhi et al., and Purnell et al., (21, 22). Similarly, the Silfverskiöld test's positive results in our study participants validated its utility in assessing isolated gastrocnemius tightness, challenging the misconception that dorsiflexion past neutral negates the presence of tightness(13, 23).

Despite its strengths, the study acknowledges limitations including the geographic constraint to one city, which may not fully represent the broader Pakistani population. Difficulties in performing the Silfverskiöld test due to the unavailability of a plinth and potential examiner bias in goniometer measurements were also noted. Moreover, the study did not explore other risk factors known to contribute to heel pain, such as body mass index and foot morphology (24-26).

Given these limitations, recommendations for future research include conducting more extensive studies across Pakistan to better understand heel pain's epidemiology and etiology. It is suggested that goniometer measurements be undertaken by multiple examiners to minimize bias, and adjustments be made, such as performing the Silfverskiöld test in a sitting position when a plinth is unavailable. Additionally, raising awareness about predisposing factors for heel pain is crucial for prevention and early intervention (8, 27, 28).

CONCLUSION

In conclusion, the research affirmed a positive correlation between isolated gastrocnemius tightness and heel pain, highlighting the significance of assessing and addressing gastrocnemius tightness in the management of heel pain. This finding not only aligns with existing literature but also underscores the need for clinicians and physiotherapists to incorporate evaluations of gastrocnemius tightness into their diagnostic and treatment protocols, potentially improving outcomes for individuals suffering from heel pain.

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