MEASUREMENT OF ANKLE DORSIFLEXION IN PATIENTS WITH HEEL PAIN

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ABSTRACT

Plantar and posterior heel pain is a common condition seen in orthopedic outpatient department. Gastrocnemius contracture has been attributed to the cause of heel pain in general. Gastrocnemius contracture can easily be diagnosed by Silfverskiöld test in the outpatient department. A cross-sectional study was performed in 60 patients in Department of Orthopedics and Trauma of Nepal Medical College Teaching Hospital from November 2023 to April 2024 after ethical approval (Ref No. 29-080/081). Measurement of ankle dorsiflexion with digital goniometer and Silfverskiöld test was performed in patients with posterior and plantar heel pain. The mean age of 60 patients with heel pain was 45.28 years (SD 11.21). Out of these, 66.6% had plantar heel pain, 33.3% had posterior heel pain. Eighty percent were female, and 60.0% had left-side involvement. BMI was normal in 35.0%, while 65.0% were overweight or obese. Gastrocnemius contracture affected 33.3% of heels, and 28.3% had isolated gastrocnemius contracture. Radiographs showed plantar heel spurs in 50.0% of cases and posterior calcaneal spurs in 38.3% cases. Our study concludes that reduced ankle dorsiflexion due to gastrocnemius contracture contributes to the development of both plantar and posterior heel pain. Increased body mass index is a very important contributing factor in the causation of both plantar and posterior heel pain.

KEYWORDS

Gastrocnemius contracture, plantar heel pain, posterior heel pain.

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INTRODUCTION

Heel pain is a common problem encountered in orthopedic practice.[1] It is common also in our part of the world.[2] Two types of heel pain: posterior and plantar is clinically classified.[3] The most common cause of plantar heel pain and posterior heel pain is plantar fasciitis and Achilles tendinopathy respectively.[4,5] Gastrocnemius contracture has been attributed to the cause of heel pain in general as it increases strain on both the Achilles tendon and the plantar fascia.[6,7] Gastrocnemius contracture can be diagnosed by Silfverskiöld test.[8] Gastrocnemius contracture is defined as ankle dorsiflexion ≤10 degrees in knee extension, or with a difference of 11.3 degrees in knee flexion.[9] Association of gastrocnemius contracture with heel pain has not been studied in Nepal in the past and published literature are of plantar heel pain but our study has included both plantar and posterior heel pain. Therefore, this paper reports the association between gastrocnemius contracture and heel pain.

MATERIALS AND METHODS

A cross-sectional study was performed at the department of Orthopedics and Trauma after ethical approval from the Institutional Review Committee (Ref No. 29-080/081). Patients with posterior and plantar heel pain attending the outpatient department from November 2023 to April 2024 were enrolled in the study after obtaining informed written consent. Total number of patients included in the study is 60. All skeletally mature patients of both sexes with posterior and plantar heel pain were taken into the study. The patients with bilateral heel pain, other affections of the lower limb, neurological involvement, treated cases of posterior and plantar heel pain, patients with midfoot and forefoot pain, and those with history of previous surgery on the same lower limb was excluded from the study. Demographic and other required data were entered in the proforma. Clinical examination was performed and findings were noted. Digital goniometer (GeMRed (R), Fig. 1) was used to measure the ankle dorsiflexion in knee extension and knee flexion. Silfverskiöld test was performed. The radiographs of the patients were obtained and findings were noted. Gastrocnemius contracture was defined as ≤10 degrees of ankle dorsiflexion in extension and or 11.3 degree of difference in ankle dorsiflexion when measured with knee in extension and flexion. The data were analyzed using SPSS-16 applying Chi-square test. The data was processed, and results were obtained. Level of significance was set at p value <0.05.

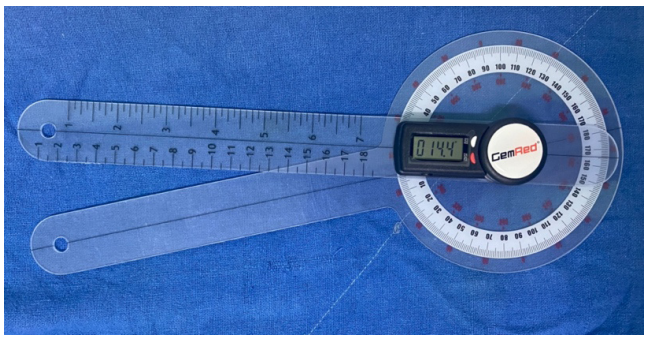

Fig. 1: Digital Goniometer (GemRed®) used for measurement of ankle dorsiflexion.

Table 1: Comparison of heel pain and gastrocnemius contracture

Type of heel pain	Gastrocnemius contracture		
	Yes	No	Total
Plantar	8 (20.0%)	32 (80.0%)	40 (100.0%)
Posterior	12 (60.0%)	8 (40.0%)	20 (100.0%)
Total	20 (33.3%)	40 (66.6%)	60 (100.0%)

Pearson Chi-square value: 9.600, p value 0.002

RESULTS

The mean age of the patients was 45.28 years with and standard deviation of 11.21 years. The age of the patients ranged 20 to 71 years. Among sixty patients with heel pain, patients with plantar heel pain were 40 (66.6%) and 20 (33.3%) had posterior heel pain. Eighty percent (48) of the patients were female and remaining twenty percent (12) were male. Sixty percent of patient had left side involvement and remaining forty percent had right side involvement. Body mass index of 21 patients (35.0%) were normal, 26 (43.3%) patients were overweight and 13 (21.7%) patients were obese. Total 65.0% of the patients were overweight or obese in our study. Among all patients, 20 (33.3%) had gastrocnemius contracture and Silfverskiöld test was positive in 17 (28.33 %) patients. This means that isolated gastrocnemius contracture was seen in 17 patients and combined gastro-soleus contracture was seen in 3 (5.0%) patients. Thirty-nine patients were diagnosed as plantar fasciitis and 22 patients were diagnosed as insertional Achilles Tendinopathy (IAT). In this study, among the patients with gastrocnemius contractures, Achilles tendinopathy was the diagnosis in 60.0% (12) and in 40.0% (8) of the patients, plantar fasciitis was the diagnosis. The total number of gastrocnemius contracture was present in 12 out of 20 patients i.e 60.0% in patients with Achilles tendinopathy in

comparison with 8 out of 40 i.e only 20.0% with plantar fasciitis had gastrocnemius contracture (Table 1). Isolated gastrocnemius contracture was seen in 11 patients out of 20 i.e 55.0% in patients with Achilles tendinopathy whereas in patients with plantar fasciitis it was 6 out of 40 i.e 15.0% only. On radiographic findings, 30 (50.0%) had plantar heel spur, 23 (38.3%) had posterior calcaneal spur, 14 (23.3%) had sclerosis of the posterior calcaneal tuberosity, 5 (8.3%) had calcification over the tendoachilles and 3 (5.0%) had os trigonum.

DISCUSSION

These results of this study have highlighted the impact of gastrocnemius contracture in heel pain either plantar or posterior. It has re-emphasized the role of gastrocnemius contracture and its treatment in patients with heel pain in our patient cohort of Nepali population. In this context, our study is comparable with the previous study[10] but the percentage of patients with gastrocnemius contracture is less in our study as compared to their study, even though both studies have highlighted the role of gastrocnemius contracture in the patients with heel pain, particularly plantar fasciitis and Achilles tendinopathy.

This study demonstrates that 33.3% of the patients had gastrocnemius contracture, with a significant portion (28.33%) showing isolated gastrocnemius contracture based on the Silfverskiöld test. The findings are comparable to earlier studies such as by DiGiovanni *et al*,[11] which emphasized that gastrocnemius tightness has a critical role in heel pain and affects ankle dorsiflexion. They have also highlighted that the isolated gastrocnemius contracture have a significant contribution in heel pain. Our study also has shown that isolated contracture of the gastrocnemius is common. As there are a significant number of patients with Achilles tendinopathy with gastrocnemius contracture in our study, so the impact of gastrocnemius contracture in Achilles tendinopathy has been highlighted and it has also been shown in previous study.[12]

Gender distribution: Both types of heel pain showed more female gender predilection. Patients with gastrocnemius contracture had more female gender predilection. Different studies have shown that female predilection is common in both posterior and plantar heel pain although it is not significant statistically. This finding of our study is comparable with the published literature.[4,13]

Types of heel pain: Our study found that 66.6% of the patients had plantar heel pain and 33.3% had posterior heel pain. Plantar heel pain has been reported as a common cause of heel pain than posterior heel pain particularly in middle aged women as shown by different studies.[13,14] Similar findings are noted in our study as well. The difference between the two types of heel pain is important. Plantar heel pain is linked to plantar fascia and is more of a mechanical strain on the fascia whereas the posterior heel pain is a completely different problem as it is related to the Achilles tendinopathy or Haglund's deformity. In the literature, broader view with definite distinction between the two types of heel pain has been clearly mentioned.[14,15]

Both types of heel pain have shown association with gastrocnemius contracture. But posterior heel pain has more association with gastrocnemius contracture as compared to the plantar heel pain, which has been shown in our study and it is significant clinically as well as statistically. As a general thought, posterior heel pain is related to the tendinopathy of the Achilles tendon, as the Achilles tendon is the combination of the gastrocnemius and soleus muscles of the calf. So, it is obvious that the disease of the tendon of the same muscles causes the contracture of the muscles from which it is originating from. There are very few studies[5] which have studied the posterior heel pain alone and its relation to gastrocnemius contracture and few studies have studied the outcome of recession of the gastrocnemius in posterior heel pain.[9,12] This shows the relation of the gastrocnemius contracture with posterior heel pain is an established entity.

Role of BMI in heel pain: Association of heel pain and obesity is very well described in the literature, which is also proved by our study as it shows that 65.0% of the patients were either overweight or obese. This is consistent with studies previously published findings,[16] where increased body mass index has been shown to be a significant risk factor for plantar fasciitis and other forms of heel pain. Obesity increases the mechanical load on the foot, exacerbating strain on the plantar fascia and Achilles tendon, which leads to the development or worsening of symptoms. This finding highlights the importance of addressing weight management in the treatment of heel pain, as emphasized in both our study and the broader literature.[17] Although clinically significant, but the statistical significance has not been proven in our study about the association of BMI and heel pain.

Gastrocnemius contracture and heel pain: The Silfverskiöld test for assessment of the

gastrocnemius contracture was used in our study which is a standard and widely used clinical test to diagnose gastrocnemius contracture.[8] Gastrocnemius contracture, as assessed through the Silfverskiöld test, was found in 33.3% of patients in our study. This finding is similar to those reported by other authors who demonstrated a high prevalence of gastrocnemius contracture in patients with heel pain, especially plantar fasciitis.[10-12] DiGiovanni and colleagues[11] found that isolated gastrocnemius tightness can lead to increased tightness or tension on the plantar fascia and Achilles tendon, causing pain in both regions.

The importance and biomechanical effects of gastrocnemius contracture which causes limited ankle dorsiflexion has already been studied in different population cohorts. Gastrocnemius contracture not only causes plantar or posterior heel pain but also is associated with other foot and ankle problems like forefoot pain, midfoot pain, pes planus which emphasizes that the contracture has broader role to play in the foot and ankle biomechanics.[18,19] The literature has highlighted the role of gastrocnemius contracture by proving the role of stretching exercises or release of the gastrocnemius muscle to overcome the contracture can improve the outcomes of management of heel pain.[15,20]

Heel spurs and radiographic findings: Our study found that 50.0% of the patients had plantar heel spurs, and 38.3% had posterior calcaneal spurs, a result that is consistent with other studies examining the radiographic features of heel pain.[21] Although heel spurs are common among patients with plantar fasciitis, but that doesn't necessarily co-relate with the symptom severity but it might be an indication that there is chronic traction forces occurring at the point of attachment of the plantar fascia.[22]

Posterior calcaneal spurs are often linked to Achilles tendinopathy, as shown in previous studies also.[23] They have found a strong connection between the formation of these spurs and chronic Achilles tendon irritation.[23] Our study's radiographic findings support this, reinforcing the importance of using imaging when evaluating heel pain. Identifying factors like spurs and sclerosis of the calcaneal tuberosity can play a key role in understanding and treating the underlying causes of pain.

Limitations in comparison to other studies: While our study supports many of the findings from previous research, it has certain limitations when compared to other studies. For instance, our study did not include a control group or assess the long-term outcomes of treatment interventions such as stretching exercises or surgical release of the gastrocnemius. In contrast, studies like DiGiovanni *et al*.[11] and Maskill *et al*,[18] included intervention groups and demonstrated the efficacy of gastrocnemius release in improving heel pain outcomes. Additionally, our study focused primarily on a Nepalese population, and while the findings are consistent with studies from other regions, further research would be needed to assess any population-specific differences in heel pain etiology and treatment responses.

In conclusion, our study is has shown similar results with the published literature regarding role of gastrocnemius contracture in heel pain. The findings support the hypothesis that reduced ankle dorsiflexion due to gastrocnemius contracture contributes to the development of both plantar and posterior heel pain. It also has highlighted the role of gastrocnemius contracture in posterior heel pain in comparison to plantar heel pain in Nepali population. It also emphasizes that weight reduction is clinically important in managing heel pain.

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