

Association Between Plantar Fasciitis and Isolated Contracture of the Gastrocnemius

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ABSTRACT

Background: Current evidence suggests that limited ankle dorsiflexion is an etiologic factor for plantar fasciitis. This limitation can arise from either an isolated contracture of the gastrocnemius or from a contracture of the gastrocnemius-soleus complex. This study's aim was to determine the proportion of patients with plantar fasciitis that have an associated isolated gastrocnemius contracture. **Materials and Methods:** This investigation was a prospective evaluation of patients with either acute or chronic plantar fasciitis. Two hundred fifty-four patients with plantar fasciitis were included. Patients were assessed for the existence of limited ankle dorsiflexion which was further characterized by noting the presence of an isolated gastrocnemius contracture or contracture of the gastrocnemius-soleus complex. The patient's duration of symptoms, type of occupation, and body mass index were also documented. Patients with acute plantar fasciitis were defined as having symptom duration of 9 months or less while those with chronic plantar fasciitis were those with over 9 months of symptoms. The Wilcoxon rank sum and chi square tests were used to compare characteristics between the acute and chronic populations. **Results:** Eighty-three percent (211 of 254 patients) had limited ankle dorsiflexion. Fifty-seven percent (145 of 254) had an isolated contracture of the gastrocnemius, 26% (66 of 254) had a contracture of the gastrocnemius-soleus complex, and 17% (43 of 254) did not have a dorsiflexion limitation. Patients were further stratified into acute versus chronic symptom duration at the time of presentation. Equinus contracture was noted in 83% (129 of 155) of acute cases, and 82% (82 of 99) of chronic cases. An isolated contracture of the gastrocnemius was found in 60% (93 of 155) of acute, and 52% (52 of 99) of chronic cases. A gastrocnemius-soleus complex contracture was noted in 23% (36 of 155) of acute cases, and 30% (30 of 99) of chronic cases. Patients with chronic plantar fasciitis had a significantly higher

number ($p < 0.05$) of medical comorbidities than those with acute plantar fasciitis. **Conclusion:** Limited ankle dorsiflexion is commonly associated with plantar fasciitis and more than half of these patients had evidence of an isolated gastrocnemius contracture. These findings can be utilized to develop and further refine non-operative and operative treatment strategies for those with recalcitrant plantar fasciitis.

Level of Evidence: IV, Case Series

Key Words: Gastrocnemius Contracture; Plantar Fasciitis

INTRODUCTION

Proximal plantar fasciitis is a common condition responsible for an estimated 11% to 15% of all foot complaints requiring medical evaluation.⁷ This, in turn, translates into over one million outpatient medical visits annually for this condition in the United States.¹¹ The etiology of plantar fasciitis is multi-factorial and has been linked to increased age and body mass index, as well as work-related weightbearing activities.⁷ In addition, a recent study by Riddle et al. identified limited ankle dorsiflexion as an additional risk factor. In that study, the degree of ankle dorsiflexion was measured with the knee in extension, and no attempt was made to discern if an isolated contracture of the gastrocnemius was present.¹⁰ Limitation in ankle dorsiflexion can result from either a contracture of the gastrocnemius soleus complex or from an isolated contracture of the gastrocnemius muscle. This can be clinically identified by the Silfverskiold test in which the degree of ankle dorsiflexion is measured with the knee both fully extended and with the knee bent, a condition that relaxes the gastrocnemius muscle and fascia. This test must, in turn, be performed with Chopart's joints reduced in order to correctly quantify ankle dorsiflexion rather than movement resulting from the unlocked midfoot and hindfoot complex. Recent studies suggest that an isolated contracture of the gastrocnemius muscle is present in a significant proportion of patients with midfoot and forefoot pathology.⁶ The goal of this study was to determine the prevalence of the association of an isolated contracture of the gastrocnemius with plantar fasciitis.

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MATERIALS AND METHODS

This investigation was a prospective evaluation of patients with either acute or chronic plantar fasciitis who presented to the senior author's (B.D.) office between July 2007 and March of 2009. This study was reviewed and approved by our center's institutional review board. Patients with acute plantar fasciitis were defined as having symptom duration of 9 months or less while those with chronic plantar fasciitis were those with over 9 months of symptoms. Data was not collected regarding previous treatment for this condition. After the diagnosis of proximal plantar fasciitis was confirmed, each patient was assessed for the existence of limited ankle dorsiflexion with the knee fully extended. The etiology of the limited dorsiflexion, characterized by noting the presence of an isolated gastrocnemius contracture defined as ankle dorsiflexion of less than 5 degrees during knee extension that corrected with knee flexion to 90 degrees, or a contracture of the gastrocnemius-soleus complex which was defined as less than 10 degrees of ankle dorsiflexion regardless of knee position. These measurements were established in a previous study.⁶ All of the patients were examined by a single fellowship-trained orthopaedic foot and ankle surgeon (B.D.) The examination was conducted with the patients in the seated position. The evaluation of the degree of ankle dorsiflexion was performed with the hindfoot joints maintained in a reduced position in order to lock these joints to prevent measurement error (Figure 1). The clinical impressions of the first examiner regarding the presence of an equinus contracture and its etiology were recorded and subsequently reassessed by a second examiner in a random subset of patients (28 patients) via goniometric evaluation. These patients had varying diagnoses and were used to check the accuracy of the first examiner using a goniometer as an objective measurement device. The number of patients comprising this subset was not based on statistical analysis, however, proved to be a random subset within the senior authors practice. The measurements of the second examiner were taken at the same patient visit after the patient had been seen by the senior author.

These findings as well as each patient's duration of symptoms, body mass index, medical comorbidities (which included diabetes, as well as other conditions such as high cholesterol, hypertension, thyroid dysfunction and others) and smoking status were documented. Statistical analyses were performed via the Wilcoxon rank sum test for age, body mass index and comorbidities and the chi squared test for gender and diabetes differences between the acute and chronic plantar fasciitis groups. Data was considered significant if $p < 0.05$.

RESULTS

Two hundred fifty-four patients with plantar fasciitis presented within the eligible time frame, and all were included in this study. The demographics of this group

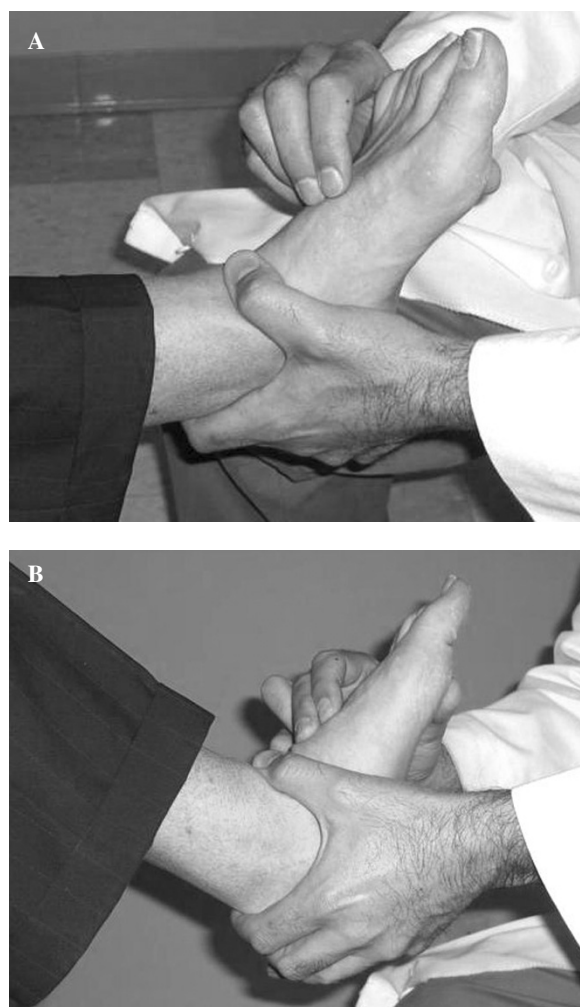


Fig. 1: Illustration of patient exam in the seated position. The hindfoot joints are reduced first. Then ankle dorsiflexion is tested with the knee fully extended (A), followed by testing with the knee flexed to 90 degrees (B).

are summarized in Table 1. Of this group, 83% (211 of 254 patients) had an equinus contracture or limited ankle dorsiflexion with the knee in full extension. Fifty-seven percent (145 of 254) of those presenting with plantar fasciitis had an isolated contracture of the gastrocnemius, 26% (66 patients of 254) had a contracture of the gastrocnemius-soleus complex, and 17% (43 of 254) did not have limited ankle dorsiflexion (Figure 2).

Patients were further stratified into acute and chronic symptom duration at the time of presentation (Table 2). Equinus contracture was noted in 83% (129 of 155) of acute cases, and 82% (82 of 99) of chronic cases. An isolated contracture of the gastrocnemius was found in 60% (93 of 155) of acute, and 52% (52 of 99) of chronic cases. Lastly, a gastrocnemius-soleus complex contracture was noted in 23% (36 of 155) of acute cases, and 30% (30 of 99) of chronic cases. When comparing the two groups, there was no statistically significant difference in the distribution of contracture type.

Table 1: Plantar Fasciitis Patient Demographics

	Plantar Fasciitis	Acute Plantar Fasciitis	Chronic Plantar Fasciitis
Number of Patients	254	155	99
Female/Male	1.6	1.5	1.9
Avg Age (Yrs)	49	50	49
Diabetes	9%	11%	4%
Body Mass Index	30.18	30.65	29.59

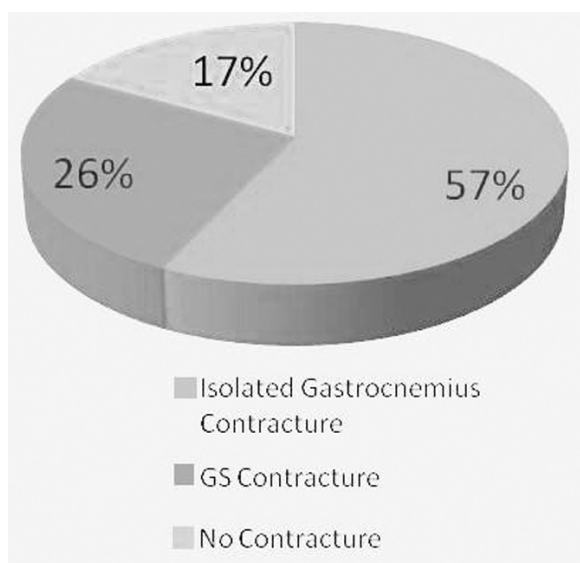


Fig. 2: All patients with plantar fasciitis, with their associated contracture.

Further evaluation of associated demographics noted that patients with a gastrocnemius and soleus contracture were older than those with an isolated contracture of the gastrocnemius muscle (52.9 years old versus 46.2 years old, $p = 0.02$). In addition, patients with chronic plantar fasciitis had statistically more medical comorbidities ($p = 0.01$) than those with acute symptoms (1.14 versus 0.94). This difference in the number of medical comorbidities may not be clinically significant since the number of comorbidities is essentially one for each group. There was no significant difference noted between those with acute and chronic plantar fasciitis in regards to their body mass index, prevalence of diabetes, gender ratio, and smoking status.

The clinical exam of patients with an isolated contracture of the gastrocnemius muscle demonstrated a sensitivity of 89% and a specificity of 90% when compared to goniometric evaluation.

DISCUSSION

Previous studies have associated an ankle equinus contracture, regardless of etiology, with plantar fasciitis.¹⁰ To our knowledge, this is the first prospective study to evaluate for and report on the association between an isolated gastrocnemius contracture and plantar fasciitis, whether acute or chronic in duration. Knowledge of the high prevalence of an isolated contracture of the gastrocnemius muscle in patients with plantar fasciitis provides information that can be utilized by clinicians to enhance non-operative and operative treatments.

The majority of patients with plantar fasciitis will obtain relief with nonoperative management, yet pain and activity limitations often persist and symptom duration of many months is not uncommon.⁷ Current treatment protocols typically utilize stretching exercises applied to either the posterior leg compartment structures or to the plantar fascia itself.^{4,5} Information regarding the nature of these patients' contracture may be utilized to determine the prescription of a more targeted physical therapy protocol. Those with an associated contracture of the gastrocnemius muscle, for instance, may benefit from stretching of this specific muscle in addition to performing the plantar fascia specific stretching protocol.

Surgical management is reserved for those with recalcitrant symptoms. Of those with acute plantar fasciitis, an estimated 10% will progress to chronic symptoms.³ An unknown percentage of these patients will fail further nonoperative management. Based on the information obtained from the current study's findings, these patients can potentially be stratified into a surgical procedure on the basis of their associated contracture type. In those patients with plantar fasciitis with an equinus contracture secondary to gastrocnemius and soleus contracture, a common surgical approach includes either partial or total release of the plantar fascia through either an endoscopic or open technique with the addition of nerve decompression. More recent studies which include patient derived outcome measures have demonstrated that plantar fascia release for those with chronic plantar fasciitis yields a satisfaction rate of less than 50% due to persistent pain and activity limitations.² Complications included persistent pain, the development of complex regional pain

Table 2: Type of Contracture Categorized by Duration of Plantar Fasciitis Symptoms

	Equinus contracture	Isolated contracture of the gastrocnemius	Gastrocnemius-soleus contracture	No contracture
Acute Plantar Fasciitis	83% (129/155)	60% (93/155)	23% (36/155)	17% (26/155)
Chronic Plantar Fasciitis	82% (82/99)	52% (52/99)	30% (30/99)	17% (17/99)

syndrome, medial arch collapse as well as the development of a painful plantar incision.

Patients with chronic plantar fasciitis with an isolated contracture of the gastrocnemius, in contrast, may be candidates for a surgical approach which targets the contracted gastrocnemius. Isolated release of the fascia of this muscle through a Strayer procedure¹⁴ or a modified Strayer, may provide some degree of symptom relief while avoiding the limitations of direct plantar fascia release. When compared to a plantar fascia release, potential advantages of this procedure include a shorter period of postoperative immobilization, earlier return to full activity, and the avoidance of a plantar foot incision and scar. In addition, the morbidity of direct release of the plantar fascia itself including the collapse of the longitudinal arch and lateral foot pain may be avoided. There has been both a recently published study by Maskill et al. as well as a recent podium presentation regarding gastrocnemius recession to treat chronic heel pain including those with plantar fasciitis.^{1,8} In the study by Maskill et al., 29 patients with chronic heel pain and an isolated gastrocnemius contracture were treated with release of the contracted gastrocnemius. A retrospective analysis of these patients by the use of a visual analog scale showed generalized satisfaction with the procedure with a decrease in the preoperative pain scale from 8/10 to 2/10 postoperatively. The advantages of a gastrocnemius recession over a plantar fascia release become more pointed in those with chronic plantar fasciitis who in this study as a group had slightly more medical comorbidities than the group of patients with acute plantar fasciitis (1.14 versus 0.94, respectively). These comorbidities, the most common of which was diabetes, may make surgery on the posterior aspect of the leg more desirable than procedures on the foot itself in this patient group. The limitations of a gastrocnemius recession, in comparison, are relatively mild and include injury to the sural nerve and a decrease in plantarflexion strength as measured in the short term.^{12,13} The long-term decrease in plantarflexion strength, however, is not well characterized. Studies have shown that a significant difference in strength exists at the 5-month period; however, at 18 months, this difference is no longer significant. The increase in ankle dorsiflexion in this and other series is approximately 18 degrees.⁹ High quality, prospective studies are needed to further evaluate the role and effectiveness of a gastrocnemius recession for patients with chronic plantar fasciitis and an isolated gastrocnemius contracture.

Limitations of this current study include the lack of a control patient population. There is, however, a historical control presented in the literature that noted 24% of asymptomatic patients demonstrate an isolated contracture of the gastrocnemius.⁶ Another limitation of this study is the lack of a widely accepted gold standard for evaluation of ankle range of motion. To assess the correlation between clinical exam and goniometric measurement in the evaluation of associated limited ankle dorsiflexion, we utilized a handheld

goniometer in a subset of our patients. We noted that our clinical exam correlated reasonably well, with sensitivity and specificity of about 90%.

CONCLUSION

The majority of patients with plantar fasciitis presented with limitation of ankle dorsiflexion. In more than half of these patients, the etiology of the equinus contracture was due to an isolated gastrocnemius contracture. Therefore, patients with plantar fasciitis should be routinely evaluated for an isolated gastrocnemius contracture. Awareness of a contracture may allow for advancement in nonoperative and operative treatment approaches for acute or chronic plantar fasciitis. Further clinical studies focusing on patient outcomes are warranted to determine if gastrocnemius recession would provide a potential operative adjuvant in those with recalcitrant plantar fasciitis and an isolated contracture of the gastrocnemius muscle.

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