

## Gastrocnemius Recession to Treat Isolated Foot Pain

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### ABSTRACT

**Background:** Gastrocnemius recession is performed to correct an isolated gastrocnemius equinus contracture of the ankle that may accompany foot and ankle pathology in the adult. It has been proposed that this equinus deformity leads to excessive strain throughout the foot, thus causing pain. This can manifest itself in the form of plantar fasciitis, metatarsalgia, posterior tibial tendon insufficiency, osteoarthritis, and foot ulcers. The purpose of this retrospective study was to review the efficacy of the gastrocnemius recession in providing pain relief for patients who have foot pain without structural abnormality who have failed conservative treatment and have an isolated gastrocnemius contracture. **Materials and Methods:** Twenty-nine patients (34 feet) who had chronic foot pain without any structural abnormality other than an isolated gastrocnemius contracture underwent a gastrocnemius recession and were available for follow up at an average of 19.5 (range, 7 to 44) months. The outcome measurements were related to pain relief (Visual Analog Scale) and patient satisfaction. **Results:** Preoperatively the average pain score was 8/10 which improved postoperatively to 2/10. Twenty-seven patients (93.1%) said they would recommend this procedure for isolated foot pain to a friend. Twenty-seven patients (93.1%) said they were satisfied with the results of the procedure. Twenty-three of 25 patients (92%) who had a unilateral procedure stated they would have the contralateral leg done if needed. **Conclusion:** Gastrocnemius recession was found to be an effective procedure when used to relieve recalcitrant foot pain in those patients with an isolated gastrocnemius contracture without deformity.

### Level of Evidence: IV, Retrospective Case Series

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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### INTRODUCTION

Equinus contractures of the foot have been shown to result in increased loads placed through the fore-foot during gait.<sup>1-5,7-9,13-15,17-19,26,29,33</sup> Equinus contractures have thus been thought to be a possible etiology for various chronic foot problems such as diabetic foot ulcers,<sup>1,2,5,13,22,26-28,37,40</sup> metatarsalgia,<sup>11,13,22,37</sup> hallux valgus,<sup>11,13,22,37</sup> posterior tibial tendon insufficiency,<sup>2,11,13,20,22,23,37</sup> and plantar fasciitis.<sup>13,22,26</sup>

Over the years, two types of equinus contractures have been identified: a global contracture of the combined gastrocnemius-soleus complex, or a contracture that is more subtle and isolated to the gastrocnemius muscle.<sup>2,11,20,38,39</sup> Conservative measures for the management of such contractures associated with these diagnoses primarily involve stretching the leg musculature. Studies have shown effectiveness in stretching and increasing the range of motion of the ankle.<sup>9,34</sup> However, some data imply that the gastrocnemius-soleus complex cannot be stretched.<sup>18</sup> The authors suggest that the act of triceps surae “stretching” does not actually lengthen anything in the superficial posterior compartment, but instead effectively prevents further contracture and may result in the stretching of weaker, less resistant structures, such as the plantar tendons, ligaments, fascia and capsules. Since the Achilles tendon can only “stretch” 3% to 5%,<sup>11</sup> it is the gastrocnemius-soleus contracture that must be addressed.

Surgical management for this condition began two centuries ago. Delpech,<sup>3</sup> in the early 1800's, described the first tendoachilles lengthening for the treatment of spasticity and its untoward effects on the foot. Vulpius<sup>43</sup> and Stoffel in 1913, and Strayer<sup>39</sup> in 1950 discussed the management of the spastic gastrocnemius complex with either a tendoachilles lengthening or a gastrocnemius recession. The recession was reserved for those with an isolated gastrocnemius contracture. To help differentiate these two conditions, the Silverskiold test<sup>38</sup> was introduced.

The literature initially discussed the association of various foot pathologies such as Achilles tendonitis,<sup>22</sup> plantar

fasciitis,<sup>22,26</sup> metatarsalgia,<sup>13,22,37</sup> and recurrent diabetic foot ulcers<sup>5</sup> with equinus contractures. It discussed performing a gastrocnemius recession in those patients with findings of the previously named conditions with a concomitant, more subtle, isolated contracture. However, these reports were observational and anecdotal.<sup>5,13,22,26,37</sup>

Tendoachilles lengthening has been found to be appropriate for those with a significant Achilles contracture. However, it is fraught with its own complications and risks such as overlengthening, painful Achilles tendinosis, rupture, loss of strength, and prolonged time to weight-bearing.<sup>1,10,19,25,28</sup>

The gastrocnemius recession was revisited in the orthopaedic literature in 2001. The anatomy of the gastrocsoleus complex and its relationship to the sural nerve was noted and the technique further modified, minimizing the morbidity.<sup>33,36</sup> Gastrocnemius recession is performed to correct an isolated gastrocnemius equinus contracture of the ankle that may accompany foot and ankle pathology in the adult.<sup>2,12,17,19,21,35,36,41</sup> It has been proposed that this equinus deformity leads to excessive pressure and overload throughout the foot thus causing pain and deformity.<sup>1,2,5,7,12,17,26-28,31,37,40</sup> Manifestations can be in the form of plantar fasciitis, metatarsalgia, posterior tibial tendon insufficiency, osteoarthritis, and foot ulcers.

The purpose of this retrospective study was to review the efficacy of the gastrocnemius recession in providing pain relief for patients who have failed conservative treatment for chronic foot pain and have an isolated gastrocnemius contracture without structural abnormality consistent with their pain and complaint.

## MATERIALS AND METHODS

IRB approval was obtained prior to collection of data. A retrospective study was performed from June 2002 to June 2005. The patients had all undergone an isolated gastrocnemius recession for chronic foot pain. Six months of followup was chosen as a minimum to allow for wound healing and muscle rehabilitation. All procedures were performed by one of two senior authors (JGA, DRB). The same technique was utilized.

The inclusion criteria were the following:

- 1) All patients had the diagnosis of "foot pain" without any structural abnormality.
- 2) All patients had a preoperative diagnosis of an isolated gastrocnemius contracture, as verified by the Silver-skiold test. The definition of contracture was an inability to dorsiflex at the ankle greater than neutral with the knee in extension.
- 3) All patients had conservative measures for at least 6 months, which included NSAIDs, orthotics, stretching and/or physical therapy.

- 4) All patients had no other concomitant procedures performed.

The exclusion criteria were the following:

- 1) Any patient that exhibited a foot deformity (i.e. varus, valgus, cavus, planus, etc.)
- 2) Any diabetic patient with non-healing ulcers.
- 3) All patients without an intake VAS (visual analogue scale) for postoperative comparison.

There were 1,175 total gastrocnemius recessions performed in 3 years. However, only 52 isolated gastrocnemius recessions were noted. Thirty-eight patients (43 procedures) were eligible for the study. Eight patients were unable to be contacted. One patient was known to be deceased. This left 29 patients (34 feet) involved in the study.

Eight of twenty-nine patients were men (27.6%) and 21 patients were women (72.4%). Five patients had bilateral procedures. Of those with unilateral procedures, 11 were right-sided, and 13 were left-sided. All patients were diagnosed with "foot pain". Specifically, this included 25 feet with a diagnosis of plantar fasciitis, six feet with metatarsalgia, and three feet with arch pain.

Of the 29 patients studied, three (10.3%) had undergone previous trauma to the involved limb (two involved in MVA's with resultant foot/ankle injury and one fell off a horse sustaining a calcaneus fracture). Five (17.2%) patients had undergone prior foot/ankle surgery.

All patients underwent a gastrocnemius recession. This was performed at the musculotendinous junction. Posteriorly, the sural nerve was protected, as was the soleus muscle anteriorly. The fascia was left open and the skin was closed with 3-0 monocryl and staples.

The postoperative protocol was the same between surgeons. The patients were placed into a pneumatic walking boot for 2 weeks. The patients were all made weightbearing as tolerated. They were all followed up at 2 weeks for a wound check. They were subsequently placed into a shoe, given a home exercise-stretching program to maintain their range of motion, and followed up again at 12 weeks. Overall clinical followup averaged 28.1 (range, 6 to 96) weeks.

Upon contacting the patients via mail, the average followup was 19.5 (range, 7 to 44) months. All patients were asked to complete a postoperative VAS. In addition, they were asked to fill out a questionnaire. These questions included; whether or not they were satisfied with the procedure with regard to pain relief; if they were on current pain medications for pain and if so, was it related to the surgery; if they would recommend the procedure to a friend; and if those who had only undergone a unilateral procedure would have the other side done if indicated. An independent party (DAC) evaluated the questionnaire.

The primary outcome variable for this study was the Visual Analog Scale (preoperative and postoperative). A Wilcoxon's signed rank test was performed to identify the significance of

the difference in pain preoperatively and postoperatively with statistical significance set at  $p \leq 0.05$ . Descriptive statistics were used for the demographic variables.

## RESULTS

Preoperatively the 29 patients (34 feet) reviewed rated their pain at an average of 8/10 (range, 3 to 10). Postoperatively the average pain score was 2/10 (range, 0 to 8) ( $p = 0.00001$ ). The patient who ranked her VAS an eight had had a previous plantar fascia release that had failed 2 years prior to her surgery. In addition to postoperative pain at the plantar medial tubercle, she had significant incisional pain from her previous plantar fascia release. She had undergone physical therapy for desensitization prior to her gastrocnemius recession, but it did not improve her symptoms. After the patient had undergone her gastrocnemius recession, her deep pain at the plantar medial tubercle was gone completely, however her incisional pain persisted. Upon completing the VAS, she mentioned her plantar fascial release incision hurt at an eight but the deep pain associated with her plantar fascia was at a zero.

The group was broken down by diagnosis and evaluated individually (Figure 1). The plantar fasciitis and metatarsalgia groups showed a significant difference in preoperative and postoperative pain scores. The arch pain group showed a trend toward improvement after the procedure, however, there were too few patients in the group to obtain significance.

On physical examination at their final clinical followup (average, 28.1 weeks), there was maintenance of normal foot alignment and a normal arch. Clinically, there was no evidence of collapse.

Twenty-seven of 29 patients (93.1%) said they would recommend this procedure for isolated foot pain to a friend. Twenty-seven (93.1%) patients said they were satisfied with the results of the procedure. One of the two patients not satisfied said his pain did not improve, remaining a 6/10

as it was preoperatively. The other patient who was not completely satisfied did note that at the time of her interview that her pain was at a level of 1/10 and had improved from a preoperative level of 9/10. Her dissatisfaction resulted from a postoperative deep vein thrombosis that evolved to a pulmonary embolus. She was happy with the pain relief, and expressed a desire to have the same surgery on her other leg except for the fact that she was too frightened by the thought of having another DVT. This patient was morbidly obese, but had no other risk factors for DVT.

Twenty-three of 25 patients (92%) who underwent a unilateral procedure stated they would have the contralateral leg done if needed. The other patient, besides the one mentioned previously, who was "unsure" whether or not they would have the contralateral calf done noted that his pain preoperatively was 6/10 that was reduced to 3/10.

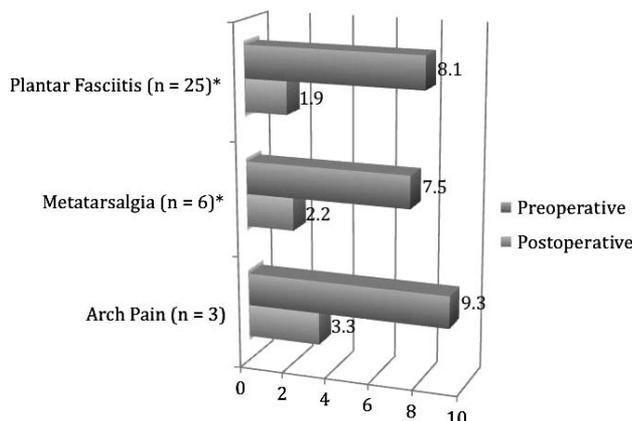
Eight of 29 patients (27.5%) noted on their questionnaire they still required pain medication, but only two (6.7%) of these patients were on narcotics. Both patients stated the pain medication was for pain unrelated to this surgery.

There were no sural nerve injuries documented. There were no wound problems noted in any patient. All healed uneventfully. No patient expressed dissatisfaction as a result of calf weakness or from the scar.

## DISCUSSION

The gastrocnemius recession has been an efficacious procedure used to treat the pediatric spastic lower extremity.<sup>4, 8, 14, 39, 43</sup> The concept that an isolated gastrocnemius muscle contracture could result in painful conditions of the foot and ankle is not new. However, the literature is sparse. The idea was originally noted by Morton<sup>17</sup> in 1935 and then reintroduced by McGlamry<sup>29</sup> in 1973.

DiGiovanni<sup>11</sup> et al. noted in his prospective study comparing patients with midfoot and forefoot pathology to an asymptomatic control group that isolated gastrocnemius



**Fig. 1:** Pain relief broken down by diagnosis. \*, shows significant differences between preoperative and postoperative pain with  $p < 0.05$  (Plantar Fasciitis,  $p < 0.00002$ ; Metatarsalgia,  $p < 0.03$ ; Arch Pain,  $p = 0.11$ ).

contracture is associated with pain and pathology in the non-neuromuscular population. Eighty-eight percent of patients in the group with midfoot and forefoot pain were noted to have gastrocnemius contractures defined as less than 10 degrees of dorsiflexion with the knee in extension (Silverskiold test<sup>38</sup>).

As research has enlightened us in this area, contracture of the gastrocnemius has been found to alter the biomechanics of the foot causing overload.<sup>2,7,11,17,31,42</sup> This overload has been thought to initially cause symptoms such as metatarsalgia, plantar fasciitis, and arch pain as subsequent strain is placed on the plantar fascia and other supporting structures. As time goes on, deformity is thought to occur. To this point, the authors believe that an equinus contracture could relate to arch collapse starting first with foot symptoms only and no deformity (a pre-collapse state), progressing to symptoms and deformity in the forefoot, midfoot, then hindfoot. The patients in this study would thus be categorized as having symptoms with no deformity (Type I arch collapse). With this hypothesis in mind, a gastrocnemius recession for these patients addresses the primary pathology. However, more carefully controlled outcome studies need to be done to definitively prove this relationship.

The tendoachilles lengthening procedure has been used as a tool to relieve pressure on the foot, specifically with diabetic foot ulcers and significant foot deformity.<sup>1,2,17,19,25,28,37</sup> Multiple authors have supported this anecdotally.<sup>5,13,22,23,26,37</sup> Sammarco et al.<sup>36</sup> looked at patients who had undergone a gastrocnemius recession with numerous other concomitant procedures. Strength testing two years post-operatively showed increasing strength over an 18 month period to 82% strength relative to the unoperated contralateral limb supporting the idea that a recession may not sacrifice significant strength. Other complications associated with tendoachilles lengthening, such as Achilles rupture, overlengthening, or prolonged postoperative course, are not known risks for a gastrocnemius recession. The biggest risk associated with this procedure is injury to the sural nerve and to a lesser extent skin dimpling and weakness.<sup>33,35,36</sup> If appropriately observed and retracted, damage to the sural nerve should be minimized. There were no injuries to the sural nerve in any of these study patients.

This is a controversial topic with a paucity of supporting literature. However, the study demonstrates the idea that the cause of the pain in the foot may not be in the foot, but rather in the calf. The gastrocnemius recession in this study population revealed a very high level of patient satisfaction, and showed acceptable effectiveness in relieving plantar fasciitis and metatarsalgia in patients without deformity. To our knowledge this relationship has not been demonstrated previously. The same trend is noted with generalized arch pain, however, the numbers in this study were too low to show significance.

## CONCLUSION

A gastrocnemius recession appears to be a safe and effective treatment for chronic foot pain in patients with an isolated gastrocnemius contracture without deformity. We believe it to be a very useful adjunct in those patients who have failed conservative measures.

## EDITOR'S NOTE

This concept is both intriguing and controversial. Debates have been held at our AOFAS meetings regarding the relationship of the tight gastrocnemius to various foot pathologies. Generally, it has seemed that those discussing the topic have been "all-or-none" speakers. Clearly, the two senior authors are impressed with their results resulting from a gastrocnemius recession as their numbers show that they have done an average of about 200 of them each per year. I am a "believer" in that I perform the procedure but certainly not at the same rate. Prospective, randomized studies would certainly help to better define the patient populations that would benefit most from this procedure.

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