CHAPTER **32**

SURGICAL TREATMENT OUTCOMES FOR PLANTAR FASCIITIS

George Rivello, DPM
Daniel Sunboliyan, DPM

INTRODUCTION

Plantar fasciitis is a common problem with the adult population and makes up 1 million visits per year to physicians (1). It occurs in a wide age range of patients, both male and female, and in both athletic and sedentary populations. The cause is unknown, but the most common theory is repetitive tearing and chronic inflammation of the plantar fascia at its insertion at the medial tubercle of the calcaneus (2). Although the majority of the patients with plantar fasciitis have resolution of symptoms within 10 months, 10% have persistent symptoms (3). Numerous nonsurgical treatment options exist, including: stretching, night splints, orthotics, casting, steroid injections, antiinflammatory medications, extracorporeal shock wave therapy, and platelet-rich plasma injections (4).

For those patients who fail to respond to nonsurgical treatments, plantar fasciotomy and gastroc recession are the preferred orthopedic operative treatments at 10-month symptom duration (5). Despite the improvements surgical intervention may bring, less than half of all patients who receive surgery for heel pain are completely satisfied (6). Plantar fasciotomy itself can be approached in a number of ways – open, percutaneous, and endoscopic have been described in the literature (7,8).

It has been proposed that an equinus deformity leads to excessive strain throughout the foot, thus causing forefoot and plantar heel pain. This can manifest itself in the form of plantar fasciitis (9,10). In fact, there are several studies that suggest that isolated gastrocnemius recession can be used as a treatment for foot pain for patients who have failed conservative therapy and have a gastrocnemius contracture (9,11).

To our knowledge, no studies yet have been made that compare the postoperative outcomes of these two reportedly widely used surgical treatments of plantar fasciitis. The surgical outcome of plantar fasciotomy with gastrocnemius recession in comparison to plantar fasciotomy alone is not known. The purpose of this retrospective study was to compare the long-term outcome of these two groups to determine the optimal surgical treatment for plantar fasciitis.

MATERIALS AND METHODS

This was a multicenter retrospective study of patients with the diagnosis of plantar fasciitis performed at a single health-care group. The institutional review board of the healthcare group approved the study with the need for informed consent prior to participation. More than 10 different surgical centers/hospitals were involved in the study, all in the same geographical area. The surgeries used in the study were performed by members of a surgical healthcare team, which consisted of more than 100 surgeons.

All patients with an ICD-9 code of plantar fasciits electronic medical records from 2005 to 2012 were considered. Patients included in this study had undergone nonoperative measures, including calf stretching, orthotic devices, and corticosteroid injections, prior to being a candidate for surgery. Six months of follow-up was chosen as a minimum to allow for wound healing and muscle rehabilitation. Both open and endoscopic plantar fasciotomy surgeries were included in the study.

Patients who were under the age of 18, pregnant women at the time of surgery, or patients with a traumatic injury to the operative foot were excluded from the study. Patients who were undergoing additional rear-foot procedures on the same foot were also excluded. Patients were also excluded if either foot had an open wound or an infection.

A data form was designed based on a modification of the Foot Function Index (12) with 19 questions that included specific foot questions pertaining to pain, disability, and activity limitations, with several added global questions. Patients were recruited using secure encrypted email. The aims of the study, as well as the risks, benefits and alternatives of participation, were explained in the email. If the patient wished to participate in the study, they responded by

accessing the encrypted email, using included instructions (Appendix A).

After a careful analysis of operative reports, similar surgical techniques were used with open and endoscopic plantar fasciotomy. Respectively procedures were performed in the operating room with the patient in the supine position and under intravenous sedation and local anesthesia. Postoperatively, a soft dressing was applied, and the patient was instructed to begin weightbearing as tolerated in a postoperative shoe for two weeks.

The open plantar fascitotomy procedure consisted of a 3.0 cm incision made on the medial aspect of the heel. Dissection was carried out until the central band of the plantar fascia was visualized and the inferior and superior margins were identified. Once identified, a transverse incision was made through approximately one-third of the fascia. After confirming the plantar fascia was cut by palpation, the wound was then copiously irrigated and the skin was closed.

The endoscopic plantar fascitotomy consisted of a minimal medial portal incision made on the medial aspect of the heel. Blunt dissection was carried out until the medial band of the plantar fascia was visualized. An obturator was advanced across the plantar fascia, and a lateral portal was created. The endoscope was introduced medially. The inferior surface of the plantar fascia was visualized via monitor. Next an endoscopic hook knife was inserted laterally and was used to make an incision along the medial one-third of the plantar fascia. An endoscopic probe was used to confirm a full thickness division. After removing the endoscopic instruments, the cut was confirmed by palpation of the plantar fascia. The wound was then copiously irrigated, and the skin was closed.

The gastrocnemius recession procedure was performed in approximately the same way by all participating surgeons. A 4-centimeter incision was made at the musculotendinous junction. The fascial plane was identified, which divides the gastrocnemius and soleus muscle. Posteriorly, the sural nerve was protected and the soleus muscle protected anteriorly. The foot was dorsiflexed with the knee extended, increasing the tension of the gastrocnemius. After making the incision in the fascia, the wound was copiously irrigated, the fascia was left open, and the skin was closed in layers. Although endoscopic gastrocnemius recession has been described, no surgeries that employed this technique were included in this study (13).

Questions from the pain subscale of the Foot Function Index were used to generate the primary numeric outcome scores. Only the first five items were used to generate an overall score, similar to previous heel pain studies (14,15). The sum of the scores of the first five items was then expressed as a percentage of a maximum possible score. The change in overall pain score from Group A (plantar fasciotomy alone) to Group B (plantar fasciotomy with gastrocnemius recession) was used for subsequent analysis. The changes in numeric scores from the first two items in the pain subscale of the Foot Function Index ("worst pain," "first steps") were evaluated separately, as they represented the primary concerns with patients who have heel pain. It has been shown that using a summed functional score, without the individual component scores, reveals little information about the effect of each component score on the overall score (16).

Student t-tests were used for comparison of pain scores. Differences between the outcome groups with respect to changes in visual analog scores for the pain subscale of the Foot Function Index were analyzed with the use of standard statistical procedures. In addition to the outcome group, other factors considered were age, sex, and body-mass index, months after surgery, and months with diagnosis of plantar fasciitis. An overall significance level was maintained at $P < 0.05$.

Results from the forms were tabulated and placed in a secured spreadsheet, along with medical record database information on each patient. Spreadsheet data were then analyzed using a public license program for statistical analysis of sampled data, PSPP 0.7.10. All data were collected and analyzed by the same investigator.

RESULTS

There were 472 total surgeries performed 2005-2012 on feet with the diagnosis of plantar fasciitis who met the inclusion criteria. One-hundred fourteen of the patients did not have valid email contact information at the time of the study. Seven of the patients were deceased. Forty patients were excluded because of rear-foot surgery or a history of trauma. The encrypted email questionnaire was sent to the 301 patients who were eligible for the study criteria.

Of the surveys sent, 35 patients responded, and 37 feet were included in the study, yielding an anticipated response rate of approximately 11.6%. Thirteen of the participants were men (37%) and 22 women (63%). Two patients had bilateral procedures. The overall mean follow-up was 48 months, with a range of 9 to 91 months after surgery. The overall age of participant was 50.2 years with a range of 28 to 73 years.

Table 1 shows the baseline characteristics of Groups A and B. There were fewer males than females (8/17) in Group A, whereas males and females were more evenly distributed in Group B (5/4). Body-Mass index, age,

Table 1

BASELINE CHARACTERISTICS

Measurement	Group A (n=25)	Group B (n=9)
Age	49.0 (28-73)	51.9 (38-63)
Gender (M/F)	8/17	5/4
Body mass index	29.7 (23-36)	28.5 (27-30)
Months follow up	53.5 (9-91)	38.7 (20-72)
Months of dx before surgery*	21.4 (1-103)	27.2 (0-108)

Group A is plantar fasciotomy alone, Group B is plantar fasciotmy with gastrocnemius recession surgical treatment.
*Note that the computer diagnosis and the actual start of symptoms may be different.

Table 2

DIFFERENCE BETWEEN PAIN SUBSCALE OUTCOMES

Measurement	Mean Change, 95% CI
Question 1 overall pain (p = 0.79)	0.27, -1.85 to 2.40
Question 2 first steps (p = 0.19)	-1.22, -3.09 to 0.65
Combined pain scores Questions 1-5 (p = 0.19)	-1.31, -3.34 to 0.72

Mean change between group A and group B, Group A is plantar fasciotomy alone, Group B is plantar fasciotmy with gastrocnemius recession surgical treatment. CI= confidence interval.

Question 1 - "How severe is your pain when its at its worst?"
Question 2 - "Pain in the morning when taking the first step?"
Question 3 - "Pain when walking?"
Question 4 - "Pain when standing?"
Question 5 - "Pain at the end of the day?"

and months follow-up were fairly evenly matched in both groups.

Table 2 shows the mean change in outcomes. For question 1 and 2 there is no statistically significant difference in pain outcomes between the two groups, ($P > 0.05$). The mean change in the average of all pain subscale scores of the Foot Function Index is also not statistically insignificant ($P = 0.19$) using an independent t-test with equal variances not assumed, confidence interval set at 95 percent. There is very little variation between pain scores of Group A and B (Figure 1). Table 3 shows the mean change in outcomes for global questions concerning overall satisfaction. There was no statistically significant difference found between global outcomes of Group A and Group B.

For the purposes of this study, endoscopic and open plantar fasciotomy were treated as the same procedure.

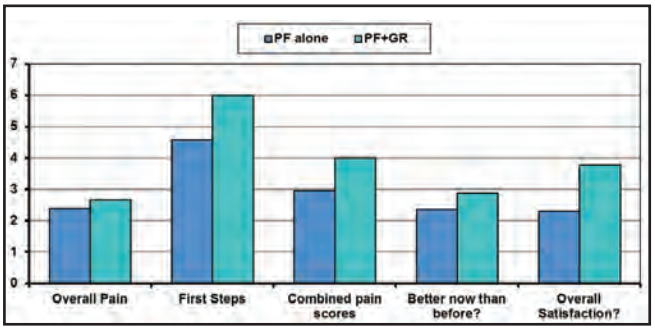

Figure 1. Pain scores of both groups.

There were no statistically significant differences in outcomes when comparing the subgroups of Group A, endoscopic and open plantar fasciotomy.

Table 3

SUBJECT RELEVANT OUTCOME MEASURES

Measurement	Mean Change, 95% CI
GQ1 (p = 0.72)	-0.37, -2.51 to 1.76
GQ2 (p = 0.38)	-1.26, -4.22 to 1.71

Mean change between group A and group B, Group A is plantar fasciotomy alone, Group B is plantar fasciotmy with gastrocnemius recession surgical treatment.

GQ1 = "How are the problems related to your foot/ankle now, compared to with before your foot/ankle surgery?"
GQ2 = "overall satisfaction"

DISCUSSION

Each group was comparable by age, sex, and body mass index. Several of the procedures were performed as percutaneous plantar fasciotomy. It is noted that one of the patients who underwent percutaneous fasciotomy bilaterally went on to repeat surgery on both feet at separate times (7). In fact, of the 3 complications noted within the 472 surgeries analyzed, 2 of the 3 were revisions of percutaneous plantar fasciotomy.

Originally, this study was designed to compare isolated gastrocnemius recession alone to open plantar fascia release. However, after a review of the records available, only 75 of the 472 surgeries selected had performed an isolated gastrocnemius procedure for plantar fasciitis, and many of these cases had a concomitant rear-foot procedure such as ankle arthrodesis and were therefore excluded from this study. Only one isolated gastrocnemius recession for the treatment of plantar fasciitis responded to this survey, a sample too small to compare to the other treatment groups. This is surprising in light of the fact that there are several published studies describing isolated gastrocnemius recession for the treatment of foot pain (9,11).

This retrospective study has limitations. The questionnaire has discrete answers that are used to create a score. This may miss more articulated responses and therefore possibly not be as sensitive. The secured email survey resulted in a very high attrition rate, about 89%, expected for such a long term follow-up. This study includes multiple techniques performed by several different surgeons. There is an unaccounted for bias by the number of years of experience each surgeon has related to outcome. Additionally, the study is a multicenter retrospective study and may have a patient population that is only representative of a group of people in a geographic area. There are variations of gastrocnemius recession such as Strayer, and gastroc intramuscular aponeurosis recession (17). Specific technique for each gastrocnemius recession is not specified in this study. Studies comparing the different types of gastrocnemius recession are lacking. Studies evaluating isolated gastrocnemius recession for foot pain are also lacking (9,17).

This study also groups together percutaneous, open and endoscopic plantar fasciotomies as the same. There were no significant statistical variations when comparing subgroups of the plantar fasciotomy technique. This echoes outcomes studied in literature, which shows that long-term outcomes between endoscopic and open plantar fasciotomies are equivalent, although the short-term outcome may show significant differences (8).

Anderson et al, who recently have produced studies suggesting isolated gastrocnemius recession is an effective treatment for foot pain (9,11) show that a gastrocnemius recession provides foot pain relief. To our knowledge, there are no studies to date that compare one type of procedure to another for the relief of plantar fasciitis.

In this retrospective multicenter case comparison study, we showed that there is no statistically significant difference between long-term outcomes for patients who have had a plantar fasciotomy with and without a gastrocnemius recession. It has been previously described in the literature that despite improvement in symptoms, prolonged recovery, and persistent pain are not uncommon. Davies reported that less than 50% of patients were totally satisfied with surgery for plantar fasciitis. Our study agrees with this finding; the mean outcomes from both groups do not show complete satisfaction and show moderate improvement only (6).

Since no pain or foot scoring was available before the surgery, it cannot be determined whether there was baseline improvement in both groups or if the groups are appropriately matched. However, it can be noted that the global questions generally show positively for both groups indicating that baseline improvement is noted in both groups. Although a retrospective study is more open to the possibilities of selection bias than a randomized prospective one, there is a wealth of good quality information already available about patients who have had this surgery.

Our study identified that gastrocneumius recession will play a role in the treatment of plantar fasciitis in the future as possible adjunctive treatment. We believe that this should be considered for patients who also have the diagnosis of an equinus deformity. However, it does not appear to make a significant impact on the long-term outcome of foot pain.

Separate foot pain scores for questions 1 (pain at its

worst), and questions 2 (first step in the morning) comparing the mean for groups A and B. Group A is plantar fasciotomy alone, and Group B is plantar fasciotmy with gastrocnemius recession surgical treatment. The outcomes are very similar, with pain scores being higher for Group B in all question categories.

Acknowledgments: We received the support of the biostatistics group of researchers at Kaiser Permanente Southern California research division, providing us with statistical consultation, data analysis, data extraction, and assistance with study design. We would also like to thank Yvonne Hung, PhD at the Institutional Review Board of Southern California Kaiser Permanente for her assistance with study design and IRB approval.

REFERENCES

1. Riddle DL, Schappert SM. Volume of ambulatory care visits and patterns of care for patients diagnosed with plantar fasciitis: a national study of medical doctors. Foot Ankle Int 2004;25:303-10.
2. Schepsis AA, Leach RE, Gorzyca J. Plantar fasciitis: etiology, treatment, surgical results, and review of the literature. Clin Orthop 1991;266:185-96.
3. Davis PF, Severud E, Baxter DE. Painful heel syndrome: results of nonoperative treatment. Foot Ankle Int 1994;15:531-5.
4. Gill LH, Kiebzak GM. Outcome of nonsurgical treatment for plantar fasciitis. Foot Ankle Int 1996;17:527-32.
5. DiGiovanni BF, Moore AM, Zlotnicki JP, Pinney SJ. Preferred management of recalcitrant plantar fasciitis among orthopaedic foot and ankle surgeons. Foot Ankle Int 2012;33:507-12
6. Davies MS, Weiss GA, Saxby TS. Plantar Fasciitis: how successful is surgical intervention? Foot Ankle Int 1999;20:803-7.
7. Borrelli AH. Percutaneous plantar fasciotomy for the surgical treatment of refractive plantar fasciitis. Tech Foot Ankle Surg 2011;10:49.
8. Kinley S, Frascone S, et al. Endoscopic plantar fasciotomy versus traditional heel spur surgery: a prospective study. J Foot Ankle Surg 1993;32:595-603.
9. Maskill JD, Bohay DR, Anderson JG. Gastrocnemius recession to treat isolated foot pain. Foot Ankle Int 2010;31:19-23.
10. Aronow MS, et al. The effect of triceps surae contracture force on plantar foot pressure distribution. Foot Ankle Int 2006;27:43-52.
11. Anderson JG, Habbu RA, Bohay DR. Treatment of recalcitrant foot pain with gastrocnemius muscle lengthening Curr Orthop Pract 2010;21:251-7.
12. Budiman-Mak E, Conrad KJ, Roach KE. The Foot Function Index: a measure of foot pain and disability. J Clin Epid 1991;44:561-70.
13. DiDomenico LA, Adams HB, Garchar D. Endoscopic gastrocnemius recession for the treatment of gastrocnemius equinus. J Am Podiatric Med Assoc 2005;95:410-3.
14. DiGiovanni BF, et al. Tissue-specific plantar fascia-stretching exercise enhances outcomes in patients with chronic heel pain a prospective, randomized study. J Bone Joint Surg 2003;85:1270-7.
15. Pfeffer G, Bacchetti P, Deland J, Lewis A, Anderson R, Davis W, et al. Comparison of custom and prefabricated orthoses in the initial treatment of proximal plantar fasciitis. Foot Ankle Int 1999;20:214-21.
16. Tornetta III P, Qadir R, Sanders R. Pain dominates summed scores for hindfoot and ankle trauma. J Orthop Trauma 2012;
17. Blitz NM, Rush SM. The gastrocnemius intramuscular aponeurotic recession: a simplified method of gastrocnemius recession. J Foot Ankle Surg 2007;46:133.

Appendix A

SURGERY QUESTIONNAIRE

This questionnaire has been designed to give information on how your foot pain affects your everyday life, after your surgery. You may reply with your answers in this email. Your email will be securely sent back securely to me at Kaiser Permanente.

Please score each question with a scale from 0 (no pain) to 10 (worst pain imaginable) that describes your foot over the past week.

No pain 0 1 2 3 4 5 6 7 8 9 10 Worst pain imaginable

In the morning upon taking your first step? _____

When walking? _____

When standing? _____

Pain at the end of the day? _____

How severe is your pain when it is at its worst? _____

Answer all of the following questions related to your pain and activities over the past week. How much difficulty did you have?

No difficulty 0 1 2 3 4 5 6 7 8 9 10 Unable to do

When walking in the house? _____

When walking outside? _____

When walking four blocks? _____

When climbing the stairs? _____

When descending stairs? _____

When standing tip toe? _____

When getting up from a chair? _____

When climbing curbs? _____

When running or fast walking? _____

Answer all of the following questions related to your pain and activities over the past week. How much of the time did you:

None of the time 0 1 2 3 4 5 6 7 8 9 10 All of the time

Use an assistive device (cane, walker, crutches) indoors? _____

Use and assistive device (cane, walker, crutches) outdoors? _____

Limit physical activities? _____

Answer this question related to your surgery overall.

No problems now 0 1 2 3 4 5 6 7 8 9 10 Much worse

How are the problems related to your foot/ankle now, compared to with before your foot/ankle surgery? _____

Answer this question related to your overall satisfaction.

Very pleased 0 1 2 3 4 5 6 7 8 9 10 Very disappointed

Overall how pleased have you been with the result of the surgery on your foot/ankle, so far? _____