

Clinical Characteristics of Plantar Fibromatosis Derived From Transcription Notes

Jill Davis, MS;¹ David Hurley, MD;¹ Jennifer Black-Shinn, PhD, MPH;² Fernando Otalora, BA;² Esteban Masuelli, BA;² and Eddie Davis, DPM³

¹Endo USA Inc., Malvern, PA; ²Amplity Health, Langhorne, PA; ³South Texas Podiatrist, San Antonio, TX

BACKGROUND

- Plantar fibromatosis (PFI) is a rare connective tissue disorder^{1,2} of the foot characterized by the formation of painful nodules, composed primarily of type I and type III collagen,²⁻⁴ causing functional disability and negatively impacting patient quality of life^{3,5-7}
- First-line treatment of PFI is focused on symptom management with conservative, nonsurgical therapies^{2,5}
 - Surgery, including local excision, wide excision, and complete fasciectomy, is indicated for refractory lesions, aggressive nodules, and nodules negatively impacting the patient's daily activities
- Treatment guidelines are unclear, and this, combined with a lack of consensus documents, makes it important to gain a better understanding of the number and characteristics of individuals impacted with PFI and to elucidate the treatments given in the real-world setting
 - Currently, there is a lack of available studies to quantify patient clinical characteristics and describe prescribed treatments for PFI
 - The lack of specific ICD codes for PFI identification adds further uncertainty to understanding the burden of PFI
- Natural language processing (NLP) combines machine learning with computational linguistics and has been used to identify and analyze diagnostic- and symptom-related information from unstructured sources, including electronic health records and transcriptions of clinical notes⁸⁻¹⁰

OBJECTIVES

- The study objectives were to use NLP of unstructured medical transcription records to describe the following: (1) the clinical characteristics of PFI; (2) the pain associated with PFI; and (3) the treatment approaches used for patients with PFI

METHODS

- This was a cross-sectional, retrospective study using the Amplity Insights unstructured medical transcription database¹¹ encompassing approximately 55 million records from more than 28 million patients
- NLP logic was leveraged to identify PFI patients and describe demographic, clinical, and treatment characteristics
- Included patients had ≥1 record with a diagnostic mention of PFI, fibroma in the plantar region, or Ledderhose disease within a transcription record between January 1, 2015, and July 31, 2022
 - Additional transcription records without a diagnostic mention of PFI occurring anytime during the background period (eg, January 1, 2013, to January 1, 2015) through the end of the study were used to identify additional transcription records related to concomitant treatments and comorbid conditions not necessarily related to PFI

- Where applicable, demographics, clinical characteristics, and treatments were compared among different strata using Chi-square/Fisher's exact test (for categorical variables), and t-test/Mann-Whitney U test/ANOVA/Kruskal-Wallis test (for continuous variables)

RESULTS

Demographic and Disease Characteristics

- The overall PFI cohort included 2273 patients (Table 1)
 - Average age at diagnosis was 56.1 years
 - PFI patients tended to be female (62.9%) and predominately Caucasian (80.8%)
 - Concomitant diagnosis of plantar fasciitis was recorded in 20.3% of patients

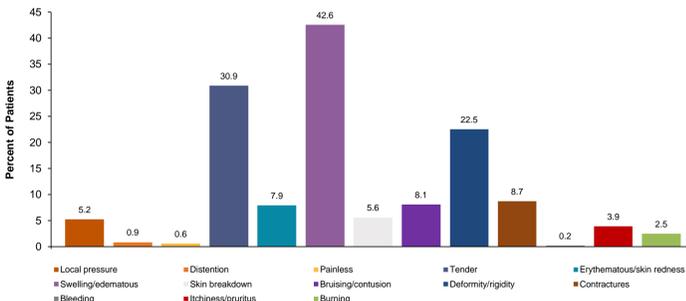
Table 1. Characteristics of Patients With Plantar Fibromatosis

Characteristic	Patients
Age, years, mean (SD)	56.1 (13.3)
Sex, %	
Female	62.9
Male	37.1
Race/ethnicity, %	
Caucasian	80.8
African American	16.5
Hispanic	2.6
US census region, %	
South	19.9
West	26.4
Midwest	37.6
Northeast	17.3
Puerto Rico	0.1
Comorbidities, %	
Plantar fasciitis	20.3
Sleep disorders/insomnia	10.7
Anxiety	10.5
Diabetes	10.5
Thyroid disease (hypothyroid or hyperthyroid)	10.0
Depression	9.9
Smoking	6.0
Headaches/migraines	4.4
Frozen shoulder/adhesive capsulitis	3.4
Rheumatoid arthritis	1.7
Connective tissue disease	1.0

Denominators used for percentage calculations are for those patients with known transcription records for each variable. Percentage calculation shown may differ from the total population sample size.

- Three-quarters of patients (1707/2273) had the presence of plantar nodules recoded in their records, and 22.7% (259/1139) reported bilateral foot nodules
- Of 735 patients (32.3%) with known nodule classification (location), 333 (45.3%) reported nodules located in the central bands, 230 (31.3%) in the medial band, and 172 (23.4%) in metatarsophalangeal (MTP) joints
- Of 381 patients (16.8%) with known nodule size, 86.9% had small (0 to <2 cm) or moderate (2 to 4 cm) nodules, with 13.1% having large nodules (>4 cm)
- Records from 1163 patients (51.2%) included mention of PFI-specific symptoms (Figure 1)
 - The most commonly reported symptoms were "swelling/edematous" (42.6%) and "tender" (30.9%)
 - In addition, 22.5% of patients reported "deformity/rigidity," and 8.7% reported having contractures

Figure 1. Percentages of Patients Reporting PFI-Specific Symptoms



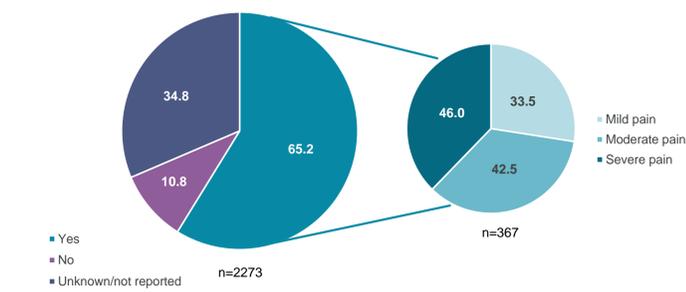
Data from n=1163 patients. PFI-specific symptoms captured from the transcription records. Symptom categories are not mutually exclusive. Patients may have reported multiple symptoms. PFI, plantar fibromatosis.

General and PFI-Specific Pain

- In the overall PFI cohort, general pain was reported by 84.3% of patients (1916/2273)
 - The records of 656 patients also included reports of general pain severity
 - Of these, 92.8% of patients reported that pain was moderate or severe
 - General pain symptoms potentially indirectly related to PFI were reported by 243 patients
 - Of these, the most common were knee pain (37.4%) and ankle pain (36.6%)
 - In addition, reports of hip pain or back pain were included in the transcription records of 64 (26.3%) and 35 (14.4%) patients, respectively
- PFI-specific foot pain recorded in 65.2% (1482/2273) of patients in the overall PFI cohort, with 88.5% recorded as moderate to severe (Figure 2)
- PFI-specific pain was reported in the transcription records of 70.9% (122/172) of patients with nodules in the MTP joints, 70.4% (162/230) in medial band, and 68.2% (227/333) in the central bands

- Among those with reports of PFI-specific pain, 63.9% (23/36) of patients with MTP joint reported their pain as "severe"
- Reports of severe pain were recorded in the records of 45.2% (28/62) and 8.8% (3/34) of patients with nodules located in the central bands or medial band, respectively

Figure 2. Percentages of Patients Reporting PFI-Specific Foot Pain



PFI-specific pain was defined as any mention of PFI pain recorded in the transcription notes, including those notes where severity is mentioned as related to the plantar region. Pain severity records includes only those transcription records that mention pain severity (mild, moderate, or severe) as related to the plantar region. PFI, plantar fibromatosis.

Treatment Patterns

- Transcription records from 2108 patients contained mention of surgical or nonsurgical treatment
- Confirmed PFI-specific surgery was defined as any mention of specific procedures (ie, local excision, wide excision, or complete fasciectomy) in proximity to the words "plantar," "nodule," "plantar fibromatosis," "fibroma," or "masses," and was undertaken by 10.9% (93/854) of patients
- Nonsurgical treatments were identified in the records of 37.3% (786/2108) of patients, with orthotics (41.1%), assistive devices (26.5%), steroid injections (20.7%), and verapamil (13.1%) the most common

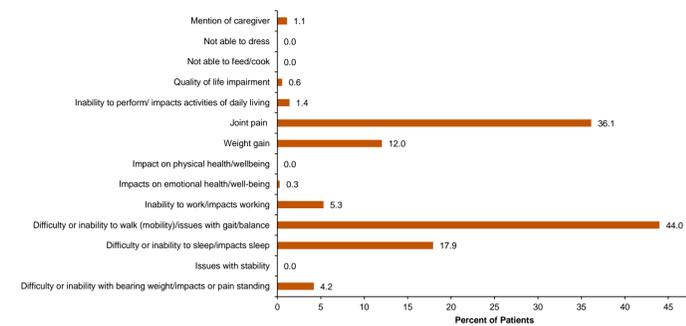
Quality of Life

- The transcription records of 15.7% (357/2273) of the overall PFI cohort contained mention of negative impacts on quality of life (QOL)
 - The most frequently reported QOL impairments were ambulation/mobility/gait issues (44.0%), joint pain (36.1%), and difficulty sleeping (17.9%; Figure 3)

REFERENCES

- Gudmundsson KG, et al. *Foot Ankle Int.* 2013;34(6):841-845.
- Carroll P, et al. *Foot Ankle Spec.* 2018;11(2):168-176.
- Espert M, et al. *Foot Ankle Int.* 2018;39(6):751-757.
- Masadeh SB, et al. *Orthopedics.* 2018;139-149.
- Young JR, et al. *Orthop Res Rev.* 2019;11:1-7.
- Veith NT, et al. *Foot Ankle Int.* 2013;34(12):1742-1746.
- Meyers AL, Marquart MJ. *StatPearls.* Treasure Island (FL): StatPearls Publishing LLC.; 2023.
- Geng W, et al. *JMIR Med Inform.* 2020;8(12):e23082.
- Koleck TA, et al. *J Am Med Inform Assoc.* 2019;26(4):364-379.
- Koleck TA, et al. *Nurs Res.* 2021;70(3):173-183.
- Amplity Health. 2024. <https://www.amplity.com/insights>.

Figure 3. QOL in Patients With PFI



Data based on patients in the overall PFI cohort with records mentioning QOL issues (n=357). Patients could report multiple QOL categories. QOL, quality of life; PFI, plantar fibromatosis.

CONCLUSIONS

- This NLP-enabled retrospective analysis of unstructured electronic medical transcription records demonstrates that patients with PFI appear to suffer from both direct and indirect symptom burden
- Most patients reported the presence of plantar nodules with nearly one-quarter reporting bilateral nodules
 - Most nodules small to moderate in size and tended to be located in the central or medial bands
- Almost two-thirds of patients in the overall cohort reported PFI-specific foot pain with nearly 90% of these describing the pain as moderate or severe
 - Patients with MTP joint nodules more frequently described their pain as severe
- Although conservative, nonsurgical treatment options were recorded, a higher than expected percentage of patients underwent surgical treatment
 - It may be possible that the effectiveness of conservative treatment was limited in these patients, and more than expected ultimately underwent surgical procedures
 - Alternatively, the NLP model may not have been precise enough to completely capture the surgical discussions
- These NLP-assisted observations, while potentially limited by a lack of inclusion of all clinical practices for patients with PFI or by missing records due to care received outside the clinical transcription network included in the database, may help to provide greater understanding of the characteristics and experiences of patients with PFI

ACKNOWLEDGMENTS

This study was supported by Endo USA Inc. (Malvern, PA). Medical writing and editorial assistance were provided by John Watson, PhD, and Stephen Publitz, ELS (PharmaWrite, LLC, Princeton, NJ) with funding provided by Endo USA Inc.

DISCLOSURES

JD and DH: Employment: Endo USA Inc.
 JB-S, FO, and EM: Employment: Amplity Health.
 ED: Disclosures for Dr Davis to be provided

