HHS Public Access

Author manuscript

Foot Ankle Spec. Author manuscript; available in PMC 2017 October 31.

Published in final edited form as:

Foot Ankle Spec. 2015 August ; 8(4): 255–259. doi:10.1177/1938640015585957.

Midfoot Charcot Neuroarthropathy in Patients With Diabetes:

The Impact of Foot Ulceration on Self-Reported Quality of Life

Katherine M. Raspovic, DPM, **Kimberlee B. Hobizal, DPM**, **Bedda L. Rosario, PhD**, and **Dane K. Wukich, MD**

Department of Plastic Surgery, Georgetown University School of Medicine, MedStar Georgetown University Hospital, Washington, DC (KMR); Heritage Valley Beaver Hospital, Beaver, Pennsylvania (KBH); Department of Epidemiology, University of Pittsburgh Graduate School of Public Health, Pittsburgh, Pennsylvania (BLR); and Department of Orthopaedic Surgery, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania (DKW)

Abstract

Introduction—Charcot neuroarthropathy (CN) and diabetic foot ulceration (DFU) are serious complications of diabetes mellitus (DM) that can result in infection, hospitalization, amputation, and have been shown to negatively affect quality of life (QOL). To the best of our knowledge, there are no studies in the literature that have specifically compared QOL in patients with diabetic CN without DFU to a group of patients with diabetic CN and concurrent DFU. The aim of this study was to compare self-reported assessments of QOL in patients with CN to a group of patients with CN and concomitant midfoot ulceration.

Materials and Methods—We compared a group of 35 diabetic patients with midfoot CN and no ulcer to a group of 22 diabetic patients with midfoot CN and concurrent DFU. Self-reported outcome was assessed using the Medical Outcome Study Short Form 36 (SF-36) health survey and Foot and Ankle Ability Measure (FAAM).

Results—No significant differences were found when comparing the 2 groups utilizing the SF-36 and FAAM with the exception that CN patients without foot ulcers had lower mean scores on the Bodily Pain Subscale. Both groups demonstrated negative impact on physical QOL and lower extremity function to a greater degree than mental QOL.

Conclusion—The presence of ulceration does not appear to significantly impact QOL in patients with CN when compared to patients with CN without ulceration.

Levels of Evidence—Prognostic, Level III: Case control

Keywords

Charcot neuroarthropathy; diabetic foot ulcer; quality of life; SF-36

Address correspondence to: Dane K. Wukich, MD, University of Pittsburgh Medical Center, Mercy Health Center, 1515 Locust Street, Suite 350, Pittsburgh, PA 15219; wukidk@upmc.edu.

Authors' Note

None of the authors declare any conflict of interest. The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The project described was supported by the National Institutes of Health through Grant Number UL1TR000005.

Charcot neuroarthropathy (CN) and foot ulceration are serious complications that occur in patients with diabetes mellitus (DM) and peripheral neuropathy.[1] A longitudinal study estimated the incidence of CN in patients with DM to be 0.3% per year, and this destructive process can be initiated by either a major or minor injury in a neuropathic lower extremity.[2] Neuropathic patients continue to ambulate on the injured extremity, provoking an acute inflammatory response that can progress to osseous collapse, significant deformity, and increased risk for foot ulceration. Several studies have demonstrated that CN negatively affects patient's quality of life (QOL).[2–6] Diabetic foot ulceration (DFU) is another complication associated with DM that is usually the result of abnormal biomechanics or presence of deformity in the setting of peripheral neuropathy and/or underlying peripheral artery disease. Similar to patients with CN, patients with DFU report lower QOL scores.[7–13] The goal of this study was to compare self-reported assessments of QOL in patients with midfoot CN and no foot ulcer to a group of patients with midfoot CN and concomitant midfoot ulceration. To the best of our knowledge, a comparative study between these 2 groups has not been published in the medical literature.

Materials and Methods

Institutional review board approval was obtained for this study. Only patients with diabetic-related CN of the midfoot (Sanders and Frykberg 2 and 3) were included.[14] Patients who had undergone previous surgery of the midfoot, hindfoot, or ankle were excluded, although patients with isolated toe surgery were included as long as a ray resection was not performed. Thirty-five diabetic patients with midfoot CN and no foot ulcer (Group 1) were compared to 22 diabetic patients with midfoot CN and concomitant foot ulceration (Group 2). Self-reported outcome was assessed using the Medical Outcome Study Short Form 36 (MOS SF-36) and the Foot and Ankle Ability Measurement (FAAM). The MOS SF-36 is a generic measure of QOL and has been evaluated for a wide variety of medical conditions including diabetes mellitus.[2,11] The SF-36 comprises 36 questions that evaluate 8 subscales: physical functioning, role physical, bodily pain, general health, vitality, social functioning, role emotional, and mental health.[12] Two distinct summary scores are calculated from these 8 subscales. The Physical Component Summary (PCS) is derived from the 4 subscales of physical functioning, role physical, bodily pain, and general health, while the Mental Component Summary (MCS) is derived from the subscales of vitality, social functioning, role emotional, and mental health. Higher scores indicate less impairment. The SF-36 has been used in several studies assessing diabetic foot disease.[2,4,8,13–15] The FAAM was developed as a region-specific measure of foot and ankle function and recently was found to be valid and responsive in assessing diabetic foot disease.[5,16,17] It is composed of an activity of daily living (ADL) and sports assessment. Twenty-one activities comprise the ADL subscale, and 8 activities comprise the sports subscale (Table 1). For each activity, the choices are no difficulty (4 points), slight difficulty (3 points), moderate difficulty (2 points), extreme difficulty (1 point), and unable to perform (0 points). The maximum score on the ADL and Sports subscales is 84 and 32, respectively. These scores are then converted to a percentage (ie, an ADL score of 42 out of 84 would be 50%). Higher FAAM scores indicate a higher level of lower extremity function.

Statistical Analysis

Descriptive statistics were summarized as frequencies (percentages, %) for categorical data or as mean ± standard deviation (SD) or median and interquartile range for normally or nonnormally distributed continuous data, as appropriate. Examination of normal distribution assumption for continuous data was determined by q-q plots and histograms. Pearson's χ^2 or Fisher's exact test, as appropriate, were used to compare the frequency distribution of categorical variables between the groups. Two-sample *t* test or Wilcoxon–Mann–Whitney test was performed to determine differences between groups for normally or nonnormally distributed continuous data, respectively. All tests were 2-sided, and the significance level was west to .05. All analyses were conducted using SAS, version 9.3, statistical software (SAS Institute Inc, Cary, NC).

Results

The 2 patient groups were similar with regard to age, gender, duration of DM, insulin use, body mass index, and anatomic location of CN (ie, Sanders/Frykberg 2 vs 3; Table 1). Charcot patients with midfoot ulcers had a higher Michigan Neuropathy Screening Index than CN patients without foot ulcers (8.1 vs 7.2, $P = .0015$; Table 1). This is due to the fact that the presence of an ulcer adds 1 point to the score. No significant differences were observed between the 2 groups with regard to SF-36 PCS and MCS scores or the 8 subscales with one exception (Table 1). Patients with midfoot CN and no foot ulcers reported lower mean scores on the Bodily Pain than patients with midfoot CN and ulcers. This would indicate that patients without ulcers self-reported more pain. Self-reported lower extremity function as measured by FAAM ADL and Sports scores did not differ significantly between the 2 groups (Table 1).

Discussion

Charcot neuroarthropathy with and without foot ulceration is associated with impairment in self-reported QOL and lower extremity function. To the best of our knowledge, this is the first study directly comparing self-reported QOL and lower extremity function in midfoot CN patients with and without concomitant foot ulcerations. As expected, patients with CN report reduced QOL and lower extremity function although mental component summary scores of the SF-36 are not affected. This has also been demonstrated in previous studies.[2–6] A possible explanation for this is that the minimal or absent pain associated with CN and foot ulceration does not cause emotional distress.[5,15] Another theory is that the SF-36 does not adequately capture foot-related emotional distress in patients with diabetic foot disorders.[15] Intuitively, one would expect diabetic patients with CN and concomitant ulceration would have lower self-reported QOL scores than CN patients without ulceration. Interestingly, our study found that there was no significant difference in QOL when comparing the SF-36 scores of a group of CN patients with and without ulceration with the exception of the Bodily Pain subscale. Multiple studies have been published regarding health-related QOL and diabetic foot disease. Studies employing the SF-36 as an outcome measure in patients with DFU have reported PCS scores ranging from 29.9 to 46.6 and MCS scores ranging from 43.2 to 57.0[7–12] (Table 2). Similar studies of CN patients demonstrate

PCS scores ranging from 27.7 to 43.6 and MCS scores ranging from 43.4 to 48.1[2–6] (Table 2). The SF-36 PCS and MCS scores of both of our groups fall within the ranges reported in the previous studies of CN and DFU and are consistent with the previously reported studies demonstrating greater impact on physical rather than mental QOL. Based on our small numbers, it appears that the presence of an ulcer does not significantly alter the patient's perception of QOL to a greater degree compared to the presence of CN without DFU. A possible reason for this is that because patients with CN usually have profound peripheral neuropathy, the presence of a midfoot ulceration does not cause pain and therefore does not cause a significant difference in their QOL when compared to patients with CN and no ulceration. An interesting finding of this study is that CN patients without ulcers self-reported the presence of more pain (by reduced Bodily Pain subscales) than CN patients with ulcers. We do not have a good explanation for this finding. Diabetic foot ulcers that become infected and require hospitalization are associated with reduced physical and mental component scores as self-reported by patients.[18]

A valid criticism of this study is the relatively small number of patients in each group, and consequently, the results of this study should be viewed accordingly. We do not know if a larger sample size would demonstrate significant differences in the outcomes. Another potential weakness of the study is that we only included patients with midfoot CN, and we recognize that other areas of the foot and ankle can be involved and cause biomechanical changes leading to ulceration. This study does not address the impact of CN and/or foot ulceration affecting the forefoot, hindfoot, or ankle; therefore, we cannot comment on the impact on QOL from these other anatomic regions. Patients with diabetic CN often present with other medical comorbidities such as coronary artery disease, nephropathy, retinopathy, and peripheral artery disease, and the impact of these comorbidities on QOL was not evaluated in this study. These comorbidities potentially could have an impact on our results, and individually have been shown to affect QOL in other studies.[13] Also, as previously mentioned and reported by Vileikyte,[15] the SF-36 may not be capturing the mental and emotional impact of lower extremity disease. A separate questionnaire may be required to better examine this. We acknowledge that another limitation of this study is that we did not address the type of treatment required in CN patients with associated foot ulcers. Patients with CN and foot ulcers require a much different treatment plan than patients with CN and an intact soft tissue envelope. Debridement, moist wound care, and offloading are the most commonly employed initial regimens, although some patients may require advanced wound care, exostectomy, or reconstruction to achieve wound healing. While this study does not demonstrate a significant difference in self-reported QOL between CN patients with and without ulcers, foot and ankle surgeons should recognize the 12 times higher risk of limb loss that is associated with CN and active foot ulcers compared to CN patients without ulcers.[19] Finally, it would have been valuable to be able to measure the QOL of CN patients prior to ulceration development in order to compare this to their QOL after development of the foot ulcer. This information ideally would be best assessed from a prospective, longitudinal study of patients with CN, assessing the QOL over a period of years. We obtained our QOL assessments at the initial visit, including both patients with and without ulcers. We also acknowledge that the ideal way to determine the impact of foot ulcers on QOL in patients with CN would be to compare the same patient prior to and after developing

a foot ulcer. Our study is comparing 2 different CN patients, one without ulcer and one with an ulcer, and this is another limitation. Unfortunately, the CN patients with ulceration initially presented with the complaint of a new ulcer, and therefore, we were not able assess their prior QOL.

Conclusion

Assessing the outcomes of treatment in patients with CN is pivotal in developing the optimal treatment methods and timing of surgical intervention. Evaluation of QOL with a generic measure of health and a region-specific measure is a useful tool to examine the impact of treatment. At the present time, literature regarding surgical treatment of CN is based on retrospective case series and expert opinion studies.[17] While this study demonstrates that the presence of an ulcer does not significantly increase the negative impact on the CN patient's perception of QOL, patients and health care providers must recognize that the risk of amputation increases by a factor of 12 in CN patients with a foot ulcer.[19] It is our responsibility as medical providers to stress the seriousness of these high-risk situations despite the fact that the presence of an ulcer may not have a direct negative impact on QOL. Although utilization of outcomes instruments may increase the burden on patients and researchers, they are essential in helping us determine the effectiveness of our medical and surgical treatment.

References

1. Rogers LC, Frykberg RG, Armstrong DG, et al. The Charcot foot in diabetes. Diabetes Care. 2011; 34:2123–2129. [PubMed: 21868781]
2. Dhawan V, Spratt KF, Pinzur MS, Baumhauer J, Rudicel S, Saltzman CL. Reliability of AOFAS diabetic foot questionnaire in Charcot arthropathy: stability, internal consistency, and measurable difference. Foot Ankle Int. 2005; 26:717–731. [PubMed: 16174503]
3. Pakarinen TK, Laine HJ, Maenpaa H, Mattila P, Lahtela J. Long-term outcome and quality of life in patients with Charcot foot. Foot Ankle Surg. 2009; 15:187–191. [PubMed: 19840750]
4. Pinzur MS, Evans A. Health-related quality of life in patients with Charcot foot. Am J Orthop. 2003; 32:492–496. [PubMed: 14620089]
5. Raspovic KM, Wukich DK. Self-reported quality of life in patients with diabetes: a comparison of patients with and without Charcot neuroarthropathy. Foot Ankle Int. 2014; 35:195–200. [PubMed: 24351658]
6. Sochocki MP, Verity S, Atherton PJ, et al. Health related quality of life in patients with Charcot arthropathy of the foot and ankle. Foot Ankle Surg. 2008; 14:11–15. [PubMed: 19083605]
7. Armstrong DG, Lavery LA, Wrobel JS, Vileikyte L. Quality of life in healing diabetic wounds: does the end justify the means? J Foot Ankle Surg. 2008; 47:278–282. [PubMed: 18590888]
8. Boutoille D, Feraille A, Maulaz D, Krempf M. Quality of life with diabetes-associated foot complications: comparison between lower-limb amputation and chronic foot ulceration. Foot Ankle Int. 2008; 29:1074–1078. [PubMed: 19026199]
9. Evans AR, Pinzur MS. Health-related quality of life of patients with diabetes and foot ulcers. Foot Ankle Int. 2005; 26:32–37. [PubMed: 15680116]
10. Meijer JW, Trip J, Jaegers SM, et al. Quality of life in patients with diabetic foot ulcers. Disabil Rehabil. 2001; 23:336–340. [PubMed: 11374523]
11. Nabuurs-Franssen MH, Huijberts MS, Nieuwenhuijzen Kruseman AC, Willems J, Schaper NC. Health-related quality of life of diabetic foot ulcer patients and their caregivers. Diabetologia. 2005; 48:1906–1910. [PubMed: 15995846]

12. Ribu L, Birkeland K, Hanestad BR, Moum T, Rustoen T. A longitudinal study of patients with diabetes and foot ulcers and their health-related quality of life: wound healing and quality-of-life changes. J Diabetes Complications. 2008; 22:400–407. [PubMed: 18413188]
13. de Meneses LC, Blanes L, Francescato Veiga D, Carvalho Gomes H, Masako Ferreira L. Health-related quality of life and self-esteem in patients with diabetic foot ulcers: results of a cross-sectional comparative study. Ostomy Wound Manage. 2011; 57(3):36–43.
14. Wukich DK, Sung W. Charcot arthropathy of the foot and ankle: modern concepts and management review. J Diabetes Complications. 2009; 23:409–426. [PubMed: 18930414]
15. Vileikyte L. Psychosocial and behavioral aspects of diabetic foot lesions. Curr Diab Rep. 2008; 8:119–125. [PubMed: 18445354]
16. Kivlan BR, Martin RL, Wukich DK. Responsiveness of the Foot and Ankle Ability Measure (FAAM) in individuals with diabetes. Foot (Edinb). 2011; 21:84–87. [PubMed: 21550796]
17. Martin RL, Hutt DM, Wukich DK. Validity of the Foot and Ankle Ability Measure (FAAM) in diabetes mellitus. Foot Ankle Int. 2009; 30:297–302. [PubMed: 19356352]
18. Raspovic KM, Wukich DK. Self-reported quality of life and diabetic foot infections. J Foot Ankle Surg. 2014; 53:716–719. [PubMed: 25128305]
19. Sohn MW, Stuck RM, Pinzur M, Lee TA, Budiman-Mak E. Lower-extremity amputation risk after Charcot arthropathy. Diabetes Care. 2010; 33:98–100. [PubMed: 19825822]

Table 1

Comparison of Final Results Between Groups 1 and 2[a].

	Charcot Without Ulcer (Group 1), N = 35	Charcot With Ulcer (Group 2), N = 22	*P* Value
Age (years)	56.7 (11.3)	57.8 (10.2)	.70
Gender (males), n (%)	21 (60%)	15 (65%)	.69
Duration of diabetes (years)	17.3 (11.2)	12.9 (7.9)	.10
Insulin use, n (%)	26 (74%)	17 (74%)	.97
Body mass index	34.4 (6.5)	35.7 (6.5)	.47
Michigan Neuropathy Screening Index	7.2 (0.9)	8.1 (1.1)	.0015
Sanders/Frykberg Classification (type 2/3)	21/14	9/13	.26
SF Physical Function	40.4 (28.4)	38.5 (28.5)	.80
Role Physical	31.6	33.3	.88
Bodily Pain	42.8 (27.8)	59.1 (29.7)	.04
General Health	45.3 (18.9)	45.7 (20.6)	.95
Vitality	46.1 (22.2)	47.8 (27.0)	.80
Social Function	57.1 (32.3)	67.4 (30.1)	.23
Role Emotional	100 (100%)	100 (100%)	.99
Mental Health	68 (32)	72 (36)	.26
PCS	30.8 (9.5)	32.3 (8.9)	.56
MCS	48.4 (12.2)	50.6 (12.5)	.52
FAAM ADL (%)	45.1 (24.8)	51.9 (12.7)	.18
FAAM Sports (%)	17.3 (20.0)	17.4 (14.1)	.99

Abbreviations: PCS, Physical Component Summary Score of the SF-36; MCS, Mental Component Summary Score of the SF-36; FAAM, Foot and Ankle Ability Measure; ADL, activities of daily living.

[a]SF-36 (average score for each subscale, PCS, and MCS) and FAAM average scores for both groups in bottom half of table (italicized).

Table 2

Comparison of Average SF-36 Scores (8 Subscales as Well as PCS and MCS) of Studies in the Literature Evaluating Self-Reported Quality of Life in Patients With Diabetic Foot Ulceration (Upper Portion of Table) and Charcot Neuroarthropathy (Lower Portion of Table).

Study	N	PF	RP	BP	GH	VT	SF	RE	MH	PCS	MCS
Diabetic foot ulcer											
Ribu et al,[12] unhealed	29	44.6	23.6	53.9	39.5	42.2	66.8	51.2	67.9	29.9	45.5
Ribu et al,[12] healed	29	55.7	28.9	57.2	52	46.1	69.1	55.5	72.2	33.4	44.8
Nabuurs-Franssen et al,[11] unhealed	230	39.2	38	60.9	52	53.1	63.8	59.2	70.1	34.6	49.5
Nabuurs-Franssen et al,[11] healed	224	44.7	26.7	58.4	53.1	51.8	60.5	47.9	65.9	35	46.5
Meijer et al[10]	14	52.1	42.9	68.7	51.1	71.2	80.4	92.3	75.7	38.2	57
Boutoille et al[8]	9	62	25	33	35	59	53	63	62	34.9	45.9
Evans and Pinzur[9]	34	36.8	32.8	56	42.3	43.7	55.9	74	67.3	33.6	48.6
Armstrong et al[7]	63	60	57	74	66	54	61	63	61	46.9	43.2
Charcot											
Dhawan et al[2]	75	30.1	16.9	47.4	44.8	34.5	52.3	48.3	52.3	27.7	45.2
Sochocki et al[6]	33									30	45
Pakarinen et al[3]	3	67.5	50	90	47.5	64	81.5	50	64	43.6	48.1
Pinzur and Evans[4]	18	34.6	10.3	41.4	44.2	37.8	42.5	55.6	61.5	30.4	45.3
Raspovic and Wukich[18]	50	42.3	40.7	51.4	47.2	47.5	62.5	66	66.9	28.3	43.4

Abbreviations: N, number of patients; PF, Physical Functioning; RP, Role Physical; BP, Bodily Pain; GH, General Health; VT, Vitality; SF, Social Functioning; RE, Role Emotional; MH, Mental Health; PCS, Physical Component Summary Score; MCS, Mental Component Summary Score.