Impact of Lymphedema on Foot-Health-Related Quality of Life: A Case-Control Investigation

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ABSTRACT

OBJECTIVE: To evaluate the foot-health-related quality of life in individuals with versus without lower-limb lymphedema.

METHODS: A case-control study was carried out in an academic clinic in Lisbon, Portugal. Eighty participants (40 controls and 40 with lymphedema) were included in the study. The researchers examined sociodemographic and clinical data and foot-health-related quality of life in both groups. In the group with lymphedema, lower-limb lymphedema was also characterized.

RESULTS: Individuals with lower-limb lymphedema had significantly lower scores on all dimensions of the Foot Health Status Questionnaire in comparison with the control group.

CONCLUSIONS: Individuals with lower-limb lymphedema appear to have a poorer foot-health-related quality of life than the general population.

KEYWORDS: foot health, lower limb, lymphedema, quality of life

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INTRODUCTION

Lymphedema is classically defined as a manifestation of the failure of the lymphatic system and/or lymph transport. This condition can be caused by problems with lymphatic development (primary lymphedema) or damage to the lymph capillaries as a result of another condition (secondary lymphedema).[1–4] Research on lymphatic physiology and microstructure indicates that all types of edema have a lymphatic component.[5] In addition, the recognition of complex patients led to the adoption of a single common category, chronic edema, which includes not only conventional lymphedema but also edema of more complex causes.[3]

The prevalence and incidence of chronic edema are underestimated;[6,7] the literature is sparse and not representative of the global population with lymphedema.[7] Lymphedema is considered a neglected condition in world public health.[2,3] Much of the disease burden of lymphedema comes from poor disease management from diagnosis to therapeutic strategies,[3,7,8] which has contributed to the high prevalence of comorbidities and complications among this population in several countries.[9–15]

Lymphedema-related literature has reported that having lymphedema may negatively impact individuals' quality of life (QoL).[1,2,6,16–18] In particular, individuals may experience decreased QoL related to function, their appearance in front of others, and the inability to find suitable shoes. The impact of lower-limb lymphedema on QoL is greater than that of lymphedema in other regions of the body (eg, upper limbs), in the domains of symptoms, body image/appearance, function, and mood.[18]

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Lower-limb lymphedema is a condition that often affects the foot[19,20] and increases the foot's susceptibility to the development of conditions affecting foot health, such as trench foot[21] and ski-jump toenails.[22] To the authors' knowledge, no studies have investigated foot-health-related QoL in people with limb lymphedema, compared with other conditions that also affect the lower limb.[23–26] Therefore, in the present study, the authors analyzed the impact of foot health on the QoL of people with versus without lower-limb lymphedema.

METHODS

This study is reported according to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) criteria.[27]

Design and Sample

This analytic, observational, case-control investigation study was undertaken during foot health screenings of people with lower-limb lymphedema at an academic clinic in Lisbon, Portugal, from April 2022 to January 2023. Authors used a consecutive and nonrandomized sampling method to recruit the 80 study participants. Inclusion criteria were people 18 years or older with a previous diagnosis of lower-limb lymphedema (lymphedema group) and healthy people 18 years or older (control group). Participants with cognitive disorders and/or other pathologic conditions that affect the foot or balance were excluded.

Procedure

Data were collected by a senior researcher, directly through an Office 365 form (Microsoft Corp) to minimize data transcription errors. Baseline measurements included questions related to sociodemographic data (age, sex, marital status, education status, and profession), general health (weight, height, body mass index applying Quetelet's equation,[28] and comorbidities), and specific foot health. Lymphedema was characterized by onset of symptoms, date of diagnosis, origin, cause, location, staging, other affected body parts, and main problems experienced.

Subsequently, participants were asked to complete the validated Portuguese version of the Foot Health Status Questionnaire (FHSQ).[29] The FHSQ was developed to assess QoL parameters related to foot health.[29–31] It is widely used in clinical and research settings because it presents detailed psychometric measures and is valid for different foot conditions and languages.[31,32]

The FHSQ is divided into three sections. The first section consists of 13 questions that assess four subscales related to foot health: foot pain, foot function, footwear, and general foot health. The psychometric characteristics of this section show a high degree of content, criterion, and construct validity (Cronbach α = .85–.88) and retest reliability (intraclass correlation coefficient = 0.74–0.92).[30] The second section consists of an adapted version of the 36-item Short-Form Health Survey, comprising 20 questions that assess another four subscales: general health, physical activity, social capacity, and vitality.[33] The third section collects data on comorbidities and sociodemographic characteristics.

The FHSQ does not produce an overall score, so the researchers followed the recommendations of the survey authors and used the FHSQ Data Analysis Software 1.03. This software determines scores for each subscale,[34] with scores ranging from 0 (worst foot health status) to 100 (best possible foot health status).[29–31,34]

Sample Size Calculation

The sample size of this case-control study was calculated for specific levels of confidence, power, and groups of equal size using OpenEpi 3.01.[35] A minimum sample size of 80 participants (40 per group) was estimated taking a two-sided confidence level of 75%, a power of 80%, and a ratio of controls to cases of 1. The actual sample (total of 80 participants) consisted of 40 cases and 40 controls.

Ethical Considerations

This study was approved by the Ethics Committee of the Portuguese Red Cross Higher Health School of Lisbon (opinion no. 01/2022), ensuring its procedures' ethical and legal compliance.[36,37] Before beginning the study, all participants received comprehensive information regarding the purpose and details of the investigation and provided written consent to participate in the study.

Statistical Analysis

The statistical analyses were performed using SPSS statistical software version 29.0 for Windows (IBM Corp). All data were subject to descriptive statistics. The Kolmogorov-Smirnov test was performed to test the normality of the quantitative data. Group comparisons were performed using Student *t* test if the data presented a normal distribution, or the Mann-Whitney *U* test if the data presented a nonnormal distribution. For the categorical data, group comparisons were performed using the frequency comparison through the χ^2 test. $P < .05$ with a CI of 95% was considered statistically significant in all the analyses.

RESULTS

Descriptive Data

A total sample of 80 individuals ranging in age from 19 to 75 years completed the research. The sample included 40 individuals with lower-limb lymphedema (lymphedema group) and 40 individuals without (control group). Table 1 presents the anthropometric characterization and sex distribution of the sample as a whole and by group. There were no statistically significant between-group differences with

Table 1. PARTICIPANT CHARACTERISTICS

	Total Group (N = 80)			Lymphedema Group (n = 40)			Control Group (n = 40)			
Variable	**Mean ± SD**	**Median ± IQR**	**Range**	**Mean ± SD**	**Median ± IQR**	**Range**	**Mean ± SD**	**Median ± IQR**	**Range**	***P***
Age, y	51.95 ± 11.60	53 ± 14	19–75	51.95 ± 11.67	53 ± 14	19–75	51.95 ± 11.67	53 ± 14	19–75	1.0[a]
Weight, kg	74.02 ± 21.30	69 ± 20	42–163	77 ± 26.82	68 ± 30.3	43–163	70.20 ± 13.03	70 ± 18	42–110	.736[a]
Height, m	1.64 ± 0.08	1.65 ± 0.11	1.48–1.85	1.6 3 ± 0.08	1.62 ± 0.12	1.48–1.78	1.64 ± 0.07	1.65 ± 0.09	1.50–1.85	.312[b]
BMI, kg/m^2	27.45 ± 7.32	25.25 ± 7.96	17.26–57.07	29.11 ± 9.20	26.19 ± 10.41	19.11–57.07	25.78 ± 4.28	25.04 ± 6.05	17.26–36.33	.392[a]
		n (%)			**n (%)**			**n (%)**		
Sex										1.0[c]
Male		12 (15)			6 (15)			6 (15)		
Female		68 (85)			34 (85)			34 (85)		

Abbreviations: BMI, body mass index; IQR, interquartile range.
[a]Mann-Whitney *U* test.
[b]Student *t* test.
[c]χ^2 Test.

respect to age, weight, height, body mass index, or sex (*P*s > .05; Table 1).

Table 2 shows the clinical characteristics of the group with lower-limb lymphedema. Half of the sample had primary lymphedema, and the other half had secondary lymphedema. The lymphedema was unilateral for 47.5% of participants, and almost half the sample (47.5%) had long-lasting lymphedema (more than 10 years). Regarding lymphedema staging, 40% of the sample was in stage 1.

Outcome Measurements

All evaluated domains of the FHSQ were affected in both groups. However, individuals with lower-limb lymphedema had lower FHSQ scores than did those in the control group. There were significant between-group differences in all domains (*P*s < .05; Table 3). The group with lower-limb lymphedema scored lowest on the domains of footwear, general health, and vitality; foot pain was the least affected dimension. In contrast, the control group scored lowest on the domains of vitality, footwear, and general health, with foot function being the least affected dimension.

DISCUSSION

To the authors' knowledge, this study is the first to investigate foot health and related QoL in individuals with lower-limb lymphedema. The results of this study suggest that individuals with lower-limb lymphedema have worse foot-health-related QoL than the general population.

Interestingly, the sample was primarily composed of women (85%), a finding that is verified in other studies and suggests that lower-limb lymphedema may affect more women than men.[17,38,39] Further, participants in both groups experienced a reduction in QoL related to foot health in all dimensions evaluated. According to the literature, there is a very high prevalence of foot problems in the general population.[40–42] These decreases are consistent with previous research showing a reduction in QoL in the control group.[25,42,43]

The lowest-scoring dimension among participants in the lymphedema group was footwear. This appears to be a common problem among individuals with lower-limb lymphedema. In a study carried out on the impact of lower-limb lymphedema on QoL, 43.3% of the sample reported having great difficulty finding suitable shoes.[17] The increase in lower-limb volume, which includes the

Table 2. CLINICAL CHARACTERISTICS OF INDIVIDUALS WITH LOWER-LIMB LYMPHEDEMA (n = 40)

Characteristic	**n (%)**
Lymphedema classification	
Primary	20 (50)
Praecox	15 (37.5)
Tarda	5 (12.5)
Secondary	20 (50)
Cancer	10 (25)
No cancer	10 (25)
Lymphedema location	
Unilateral	19 (47.5)
Bilateral	21 (52.5)
Lymphedema duration, y	
<1	1 (2.5)
1–5	12 (30)
5–10	8 (20)
>10	19 (47.5)
Stage of lymphedema	
0	5 (12.5)
1	16 (40)
2	8 (20)
3	11 (27.5)

Table 3. FHSQ SCORES FOR INDIVIDUALS WITH VERSUS WITHOUT LOWER-LIMB LYMPHEDEMA

	Total Group (n = 80)			Lymphedema Group (n = 40)			Control Group (n = 40)			
FHSQ Domains	Mean ± SD	Median ± IR	Range	Mean ± SD	Median ± IQR	Range	Mean ± SD	Median ± IQR	Range	*P*[a]
Foot pain	75.80 ± 22.58	78.13 ± 37.81	6.25–100	67.88 ± 25.15	72.19 ± 43.28	6.25–100	83.73 ± 16.48	87.50 ± 33.13	48.13–100	.004
Foot function	77.66 ± 27.63	87.50 ± 37.50	0–100	63.13 ± 30.51	68.75 ± 43.75	0–100	92.19 ± 13.48	100 ± 12.50	50–100	<.001
Footwear	43.75 ± 30.56	41.67 ± 56.25	0–100	26.46 ± 22.79	25 ± 39.58	0–83.33	61.04 ± 27.63	66.68 ± 41.67	0–100	<.001
General foot health	60.38 ± 24.45	60 ± 42.50	12.50–100	50.50 ± 24.38	42.50 ± 30	12.5–100	70.25 ± 20.41	72.50 ± 25	12.50–100	<.001
General health	56.50 ± 24.50	50 ± 38	10–100	43.75 ± 16.59	40 ± 28	20–70	69.37 ± 24.64	70 ± 40	10–100	<.001
Physical activity	67.36 ± 27.38	75 ± 44.45	5.56–100	53.61 ± 27.78	47.22 ± 48.61	5.56–100	81.11 ± 18.95	83.33 ± 27.78	22.22–100	<.001
Social capacity	71.88 ± 27.59	75 ± 46.90	0–100	61.56 ± 28.78	62.50 ± 46.90	0–100	82.19 ± 22.27	87.50 ± 37.50	12.50–100	<.001
Vitality	50.86 ± 20.52	50 ± 37.50	0–93.75	45.47 ± 18.56	43.75 ± 25	12.50–93.75	56.25 ± 21.18	56.25 ± 29.69	0–87.50	.010

Abbreviations: FHSQ, Foot Health Status Questionnaire; IQR, interquartile range.
[a]Mann-Whitney *U* test.

foot, results in increased difficulty in finding the ideal footwear. A bad shoe fit, either in size or type, also may cause an increase in other foot problems such as calluses and blisters and/or an increased risk of falling.[44] These problems can also be aggravated by changes in postural stability[45] and gait pattern[44] that can occur in individuals with this condition. The footwear dimension had the second-lowest mean score in the control group. This finding is frequent in the literature, with several studies showing that healthy people are dissatisfied with footwear, regardless of age and sex.[26,43,46,47]

Participants in the lymphedema group scored significantly lower on general foot health in comparison with the control group. Individuals with lower-limb lymphedema are more susceptible to developing foot problems, because of either inadequate footwear or other causes such as trench foot, ski-jump toenails, changes in the appearance and color of the skin, skin cracks, and risk of infection or laceration,[21,22,44] which may explain the low scores in this group. However, effectively managing the edema and decreasing the limb volume can help prevent further problems. For example, the risk of wounds can decrease by 50% with edema control;[48] skin care is equally important.[49] Although the development of wounds in lymphedema is a rare event, it is also one of the most serious. Wounds can affect the leg, foot, and toes, due to changes in the skin that alter its normal perfusion, such as inflammation, pustule formation, maceration, infection, papillomatosis, and hyperkeratosis, among others.[49]

Although pain is not one of the most prevalent symptoms in individuals with lower-limb lymphedema, many may experience this symptom,[50] which is of moderate intensity.[17] Individuals with foot pain have a lower QoL related to foot health.[51] In this study, individuals with lower-limb lymphedema had lower mean scores on the foot pain dimension in comparison with the control group, indicating they felt more pain.

The dimensions that assess QoL and health showed low values in both groups. These low values among patients in the lymphedema group align with findings from studies that used the 36-item short form survey to evaluate general health, physical activity, social capacity, and vitality.[38,39] However, in those studies, the dimension with the lowest mean scores of those four was physical activity, and in the present research, it was general health. The low scores on general health may be related to cultural aspects of the Portuguese population that are mirrored in the self-assessment of their health status: only 50.4% of the population consider themselves to be in good health, a value well below the European average.[52] Of the four dimensions assessing overall health, vitality had the second-lowest mean scores, both in the present study and in previous research.[38,39] This dimension also had the lowest mean score in the control group, which corresponds with the findings of previous research in a sedentary Portuguese population, regardless of sex.[53] This is also a common finding among control groups in case-control studies using the FHSQ, regardless of age and sex.[51,54]

The results of the present study indicate that individuals with lower-limb lymphedema may have reduced QoL related to foot health. Although there is no curative treatment for this condition, early diagnosis and proper management are key for limiting the negative effects of lymphedema on patients' lives. Complex decongestive therapy has shown good efficacy in controlling edema, proving to be a reference in the nonoperative treatment of lymphedema. This therapy includes skin care, manual lymphatic drainage, exercises, and compression with multilayer bandaging. Other compressive methods can be used as adjuncts, such as compression stockings and intermittent pneumatic compression.

Study Limitations and Strengths

This study has some limitations to consider in the interpretation and generalization of its results. The sample size made it difficult to characterize the types, locations,

and stages of lymphedema. Also, this type of self-report study may be subject to recall bias and cannot establish causality.[55] The nonprobabilistic sampling method used can also lead to selection bias as a result of possible systematic errors related to the methodology for selecting participants or factors that influence their participation, although consecutive sampling is considered the best nonprobabilistic sampling method to control selection bias by including all available participants.[56] Further, although the FHSQ is a widely used, valid, and reliable instrument, it lacks validation in individuals with lower-limb lymphedema, and this should be considered in future studies. A strength of this study is that the sample was matched by age and sex.

CONCLUSIONS

According to this study, individuals with lower-limb lymphedema have low scores on QoL related to foot health. More research is needed to understand this problem and its implications. Future studies should establish the causes that lead to decreased foot-health-related QoL in individuals with lower-limb lymphedema, to determine the necessary preventive and curative measures to minimize or control this health-related problem. Future research should also apply additional instruments with good psychometric quality that are widely used in individuals with lower-limb lymphedema, such as the Lymphedema Quality of Life-Leg Questionnaire or the Foot Function Index. ●

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