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Hand-foot syndrome and its impact on daily activities in breast cancer patients receiving docetaxel-based chemotherapy

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ABSTRACT

Purpose: Breast cancer patients who undergo docetaxel-based chemotherapy regimens can have hand-foot syndrome (HFS), which negatively impacts their ability to perform daily activities. The purpose of the study was to assess, in breast cancer patients receiving chemotherapy: the perceived levels of HFS-related symptoms of the feet, hands or fingers; and HFS-related restrictions in daily activities; as well as to identify factors associated with these symptoms and restrictions.

Methods: This cross-sectional study examined breast cancer patients who received docetaxel-based chemotherapy from the general surgery outpatient department and oncology outpatient department of a medical center in northern Taiwan. A set of structured questionnaires were used to measure patients' HFS-related symptoms and HFS-related restrictions in daily activities.

Results: Of the 85 breast cancer patients studied, 41.2% reported HFS. Patients had higher level of HFS-related foot symptoms than HFS-related hand or fingers symptoms. Greater restriction in HFS-related daily activities was associated with more HFS-related hand or fingers symptoms and more HFS-related foot symptoms; these factors explained 44.7% of the variance in restriction of activities.

Conclusion: Skin care and patient education should be provided to manage the HFS of breast cancer patients receiving chemotherapy.

1. Introduction

Surgery and chemotherapy are major treatments for breast cancer. In terms of chemotherapy, docetaxel is a critically important drug in the treatment of patients with breast cancer (Crown, 2001). Hand-foot syndrome (HFS), also known as palmar-plantar erythrodysesthesia syndrome (PPES), is one of the most common side effects of chemotherapy. It involves palmar and plantar erythema, tingling sensation, burning pain, blistering with subsequent desquamation, erosion, and ulceration (Miller et al., 2014; Nikolaou et al., 2016). HFS affects the palms more frequency than the soles. Also commonly affected are the thenar and hypothenar eminences as well as the distal fat pads and the lateral aspect of the fingers (Miller et al., 2014; Nikolaou et al., 2016). HFS typically develops within two days to three weeks following the administration of chemotherapeutic agents and may last up to 10 months post-treatment (Baack and Burgdorf, 1991; Degen et al., 2010; Farr and Safwat, 2011; Nikolaou et al., 2016). Of cancer patients treated with docetaxel who reported HFS, 6%–58% received docetaxel only, 89% received docetaxel combined with continuous 5-fluorouracil, and 56%–63% received docetaxel combined with capecitabine (Degen et al., 2010). The review by Sibaud et al. (2016) reported the incidence of docetaxel-induced HFS as approximately 5–10% for patients with grade 3 cancer.

Patel et al. (2018) reported that patients with breast cancer who received multiagent chemotherapy regimens containing docetaxel developed an atypical presentation of HFS on the dorsal aspect of the hands and feet. Dose reduction and completion of docetaxel-based chemotherapy were associated with improvement in HFS (Miller et al., 2014; Patel et al., 2018). Akoglu (2014) also showed that PPES and nail changes are common presentations of the cutaneous toxicity of

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docetaxel chemotherapy, which deteriorates the quality of life of patients.

Sibaud et al. (2011) reported that patients suffering from HFS had impaired quality of life. Anderson et al. (2015) showed that HFS-related symptoms were associated with declines in ability to perform daily activities in advanced or metastatic breast cancer patients. In a review article, Miller et al. (2014) found that chemotherapy-induced HFS and nail changes significantly impacted patients' quality of life. Komatsu et al. (2019) reported that cancer patients with chemotherapy-related HFS had unmet needs regarding barriers to social participation, decreased willingness to work and continue treatment, and need for individual coping strategies. Although HFS is not itself life-threatening, its sufferers may also experience erythema, dysesthesia, pain, cracking, and desquamation on the palms and soles; all these symptoms can decrease quality of life, as well as lead to tissue necrosis or infectious complications that may result in amputation or death (Hoesly et al., 2011). Although some studies have explored the issue related to HFS, most research has focused on HFS in multiple cancers (Komatsu et al., 2018, 2019; Mikoshiba et al., 2015) or colon cancer (Murugan et al., 2016). The aims of this study were to (1) assess breast cancer patients' perceived levels of HFS-related foot symptoms, HFS-related hand or fingers symptoms, and HFS-related restrictions in daily activities and (2) identify factors associated with HFS-related restrictions in daily activities among breast cancer patients receiving chemotherapy.

2. Methods

2.1. Design and sample

A cross-sectional, descriptive, and correlational design was used in this study. Consecutive sampling was conducted to recruit subjects from the general surgery outpatient department and the oncology outpatient department of a medical center in northern Taiwan between August 2017 and July 2018. The inclusion criteria were: (1) new diagnosis of breast cancer; (2) receiving chemotherapy with docetaxel-based regimens; (3) receiving at least two cycles of chemotherapy; (4) agreement to participate in the study after explanation of its purposes and procedures; and (4) aged 20 years or older. Patients were not eligible if they had a mental disorder, an unstable systemic disease (active infection or other underlying disease), previously skin lesions, invasive breast cancer with metastasis, or physical performance less than 60 (Karnofsky et al., 1948).

2.2. Ethical considerations

Approval from the Institutional Review Board of the medical center (201700801B0) and a permission certificate were obtained. The study conforms to the principles of the Declaration of Helsinki. Signed informed consent was obtained from all patients before data collection.

2.3. Data collection procedures

Breast cancer patients who met the inclusion criteria were contacted by a research nurse using a structured questionnaire to interview and assess HFS-related variables. The research nurse had more than 10 years' cancer care experience in breast cancer patients and was trained by an oncologist with expertise in the chemotherapy and HFS therapies of breast cancer. The training included information about the concept of HFS, procedures for administration and scoring of HFS measurements, and the questionnaire. Satisfactory inter-rater reliability was reported in the pilot study. The interview and assessment lasted approximately 10–15 min.

2.4. Measures

2.4.1. Hand-Foot Quality of Life Scale (HF QoLS) - symptom subscale questionnaire

The Hand-Foot Quality of Life Scale (HF QoLS) Symptom subscale questionnaire was used to assess HFS-related symptoms. This scale has 20 items on two subscales (HFS-related hand or fingers symptoms, 10 items; and HFS-related foot symptoms, 10 items). Considering that the initial clinical manifestations of HFS affect first the palms and later the soles, the hand or fingers and foot items were assessed separately for the signs and symptoms of HFS. Responses are scored on a scale of 0 (not at all) to 4 (always or extremely), with higher scores indicating higher symptom distress perceived by the patient (Anderson et al., 2015). The scale had convergent validity, with significant negative correlation between the HF QoLS and quality of life. The scale had discriminant validity, supported by the significant differences between grade 0 to grade 3 HFS (Anderson et al., 2015). The HF QoLS has been demonstrated to be reliable in cancer-related studies (Nam et al., 2016). The original English version of the HF QoLS was translated following the forward-backward translation procedure (Marin and Marin, 1991). Two bilingual nursing experts independently translated and back-translated the original English HF QoLS to develop the original Chinese version (Chinese version HF QoLS). The Chinese version of the HF QoLS has been translated and was evaluated by five cancer care clinical experts; it demonstrated a content validity index of 0.97. Pilot testing in 10 breast cancer patients treated with docetaxel-based chemotherapy using this scale reported satisfactory internal consistency.

The Cronbach α for the HF QoLS - Symptom subscale in this study was 0.89.

2.4.2. HF QoLS - daily activity subscale

Patients' HFS-related restrictions in daily activities in terms of quality of life were assessed using the HF QoLS Daily Activity subscale (Anderson et al., 2015). This 18-item scale has four subscales: physical (8 items), self-care (3 items), social (3 items), and psychological (4 items). Each item regarding skin toxicity has an impact on all domains (the physical, self-care, social, and psychological). Each item is scored on a scale of 0–4, with a higher score indicating greater difficulty in daily activities affecting HFS-related quality of life. The daily activity subscale has excellent internal consistency and concurrent validity, with significant positive correlation between it and quality of life (Anderson et al., 2015). The HF QoLS has been demonstrated to be reliable in a cancer-related study (Nam et al., 2016). This scale was translated into Chinese following the forward-backward translation procedure (Marin and Marin, 1991) and evaluation by experts showed it has satisfactory validity. The Cronbach α for the HF QoLS - Daily Activity subscale in this study was 0.92.

2.4.3. Common terminology criteria for adverse events 4.03v

The Common Terminology Criteria for Adverse Events (CTCAE) 4.03v was developed by the US National Cancer Institute (NCI) and is widely use in oncology care as the standard classification and severity grading scale for adverse events in cancer therapy clinical trials and other oncology settings (National Cancer Institute, 2010). Severity of HFS or PPES is measured in three grades, ranging from I to III: Grade I, minimal skin changes or dermatitis (e.g., erythema, edema, or hyperkeratosis) without pain; Grade II, skin changes (e.g., peeling, blisters, bleeding, edema, or hyperkeratosis) with pain, limiting instrumental activities of daily living (ADLs); Grade III, severe skin changes (e.g., peeling, blisters, bleeding, edema, or hyperkeratosis) with pain, limiting self-care ADLs (National Cancer Institute, 2010). The CTCAE has been widely used and demonstrated to be reliable in cancer-related skin toxicity studies (Chen et al., 2012; Hwang et al., 2016; Lacouture et al., 2014). The inter-rater reliability for this study was 0.98 between the research nurse and the oncologist who provided training to the research nurse.

2.4.4. Demographic and clinical characteristics

Demographic data (age, marital status, education level, occupation, religion, contact friction, high temperature, and humidity) and characteristics of the cancer and treatment (cancer stage, chemotherapy modalities, number of chemotherapy cycles, docetaxel total dose, time since diagnosis, and time since the completion of previous chemotherapy) were recorded by medical chart review.

2.5. Statistical methods

SPSS version 21.0 (IBM Corp., Armonk, NY, USA) was used for data analysis. Demographic characteristics, clinical characteristics, HFS-related foot symptoms, HFS-related hand or fingers symptoms, and HFS-related restrictions in daily activities were described using frequency distributions, percentages, means, and standard deviations, as appropriate. Pearson's product-moment correlation coefficient was used to examine the relationships between the HFS-related daily activities (dependent variable) and the selected independent variables (cancer stage [early *vs*. advanced], number of chemotherapy cycles, cumulative docetaxel dose, time since the completion of previous chemotherapy, HFS severity, body mass index (≥ 25 *vs*. < 25), HFS-related foot symptoms, and HFS-related hand or fingers symptoms). Multiple regression analysis was conducted to identify factors associated with the dependent variables: overall HFS-related restrictions in daily activities and four specific aspects of HFS related-daily activities (physical, self-care, social, and psychological). The independent variables found to be statistically significant in Pearson's product-moment correlation coefficient analysis (cumulative docetaxel dose, HFS severity, HFS-related foot symptoms, and HFS-related hand or fingers symptoms) were included in multiple stepwise regression analyses.

One-way ANOVA with Scheffe' post hoc was used to examine the differences in HFS-related symptoms and HFS-related restrictions in daily activities. The level of statistical significance was set at $p < 0.05$.

3. Results

3.1. Patient demographic and clinical characteristics

Of the 91 eligible patients, six declined to participate because they had no time or interest. The response rate was 93.4%. Thus, we included 85 patients in the analysis. All patients were female (n = 85, 100%). The mean age of the patients was 50.04 years (range, 28–70 years). The majority were employed (n = 44, 51.8%), married (n = 70, 82.4%), and had a high school education or more (n = 62, 84.8%). Most patients held Buddhism/Taoism religious beliefs (n = 59, 69.4%). Most patients had early stage cancer (n = 51, 60.0%) and all patients received docetaxel plus another regimen (n = 85, 100%). The average number of chemotherapy cycles was 3.59, the mean total docetaxel dose was 251.72 mg (standard deviation = 52.80, range: 180–560 mg). The average time since diagnosis was 22.61 weeks and the average time since the completion of previous chemotherapy was 3.31 weeks. A total of 41.2% (n = 35) of the study subjects had HFS severity with toxicity grade I (35.5%, n = 30) or grade II (5.9%, n = 5). The rest of the patients reported no HFS (58.8%, n = 50) (Table 1).

3.2. Levels of HFS-related symptoms and HFS-related restrictions in daily activities

The overall mean number of HFS-related symptoms was 16.39 ± 1.31, the mean number of HFS-related foot symptoms was 8.76 ± 0.72, and the mean number of HFS-related hand or fingers symptoms was 7.62 ± 0.70. The overall mean HFS-related restrictions in daily activities was 9.69 ± 1.40, with a mean subscore for physical of 5.37 ± 0.72, a mean subscore for self-care of 1.06 ± 0.22, a mean subscore for social of 1.18 ± 0.25, and a mean subscore for psychological of 2.07 ± 0.40. The overall mean HFS score was 26.08 ± 2.47 (Table 2).

Table 1
Demographic and clinical characteristics of patients (n = 85).

Variable	Number (%)	Mean (SD)	Range
Age		50.04 (9.62)	28–70
Gender			
Female	100 (100)		
Occupation			
Unemployed	41 (48.2)		
Employed	44 (51.8)		
Marital status			
Unmarried	15 (17.6)		
Married	70 (82.4)		
Education level			
None	5 (5.9)		
Elementary	8 (9.4)		
Junior high	10 (11.8)		
Senior high	36 (42.4)		
College and above	26 (30.6)		
Religion			
None	19 (22.4)		
Buddhism/Taoism	59 (69.4)		
Christianity/Catholicism	7 (8.2)		
Cancer stage			
Early stage	51 (60.0)		
Advanced stage	34 (40.0)		
Chemotherapy modalities			
Docetaxel only	0 (0)		
Docetaxel plus other regimen	85 (100)		
Number of chemotherapy cycles		3.59 (0.97)	3–8
Docetaxel, total dose, mg		251.72 (52.80)	180–560
Time since diagnosis (weeks)		22.61 (8.22)	8–40
Time since the completion of previous chemotherapy (weeks)		3.31 (1.31)	1–12
Status of HFS			
No	50 (58.8)		
Yes	35 (41.2)		
Severity of HFS			
No HFS	50		
NCI-CTCAE grade[a]	35		
[a]	30 (35.3)		
II	5 (5.9)		
III	0 (0)		

Abbreviations:
[a] NCI-CTCAE - The Common Terminology Criteria for Adverse Events (CTCAE) 4.03v.

Table 2
Scores for HFS-related symptom and HFS-related daily activities (n = 85).

Variable	Mean	Range	Theoretical scoring range
HFS-related symptoms (HF-QoLS-Symptom subscale questinnaire)[a]	16.39 ± 1.31	0–67	0–80
- Feet	8.76 ± 0.72	0–33	0–40
- Hands or fingers	7.62 ± 0.70	0–34	0–40
HFS-related daily activities(HF-QoLS-Daily Activity subscale)[b]	9.69 ± 1.40	0–57	0–72
- Physical	5.37 ± 0.72	0–27	0–32
- Self-care	1.06 ± 0.22	0–10	0–12
- Social	1.18 ± 0.25	0–11	0–12
- Psychological	2.07 ± 0.40	0–15	0–16
Overall HFS (HF-QoL Scale)[c]	26.08 ± 2.47	0–124	0–152

Abbreviations:
[a] Hand-Foot Quality of Life Scale (HF QoLS) - Symptom subscale questionnaire.
[b] HF QoLS - Daily Activity subscale.
[c] HF-QoLS Scale, Hand-Foot-Quality of Life Scale.

Table 3
HFS-related symptom and HFS-related daily activities by severity of HFS (n = 85).

Variable	HFS-related symptoms (HF-QoLS-Symptom subscale questionnaire)[a]		*F*	Scheffe' post hoc
	Mean	SE		
Severity of HFS			20.639[d]	① < ② < ③
①No HFS	50	8.33 ± 1.18		
②Grade 1[c]	30	20.33 ± 1.96		
③Grade 2[c]	5	39.00 ± 8.35		
Variable	HFS-related daily activities (HF-QoLS subscale- Daily Activity subscale)[b]		*F*	Scheffe' post hoc
	Mean	SE		
Severity of HFS			6.504[d]	① < ② < ③
①No HFS	50	6.94 ± 1.71		
②Grade 1[c]	30	10.13 ± 1.85		
③Grade 2[c]	5	26.60 ± 9.53		

Abbreviations:
[a] Hand-Foot Quality of Life Scale (HF QoLS) - Symptom subscale questionnaire.
[b] HF QoLS - Daily Activity subscale.
[c] NCI-CTCAE - The Common Terminology Criteria for Adverse Events (CTCAE) 4.03v.
[d] Significant at the $P < 0.001$.

3.3. HFS-related symptoms and HFS-related restrictions in daily activities by HFS severity

The mean of HFS-related symptoms and HFS-related restrictions in daily activities scores stratified by HFS severity showed that scores increased by HFS severity. The HFS-related symptoms scores of patients with no HFS, toxicity grade I, and II were 8.33 ± 1.18, 20.33 ± 1.96, and 39.00 ± 8.35, respectively. The HFS-related restrictions in daily activities scores of patients with no HFS, toxicity grade I, and II were 6.94 ± 1.71, 10.13 ± 1.85, and 26.60 ± 9.53, respectively. One-way ANOVA with Scheffe' post hoc indicated statistically significant differences in the mean HFS-related symptoms and HFS-related restrictions in daily activities scores of patients who received chemotherapy with docetaxel (Table 3).

3.4. Correlates of HFS-related restrictions in daily activities

Pearson's product-moment correlation coefficient was used to examine the relationships between the HFS-related daily activities, HFS-related symptoms, and selected characteristics of the cancer and treatment. The factors significantly correlated with the overall HFS-related daily activities score were: cumulative docetaxel dose ($r = 0.27$, $p < 0.05$), HFS severity ($r = 0.40$, $p < 0.01$), HFS-related foot symptoms ($r = 0.61$, $p < 0.001$), and HFS-related hand or fingers symptoms ($r = 0.67$, $p < 0.001$) (Table 4).

3.5. Factors associated with HFS-related restrictions in daily activities

We performed multiple regression analysis to identify factors significantly and independently associated with overall HFS-related restrictions in daily activities, and in the physical, self-care, social, and psychological aspects of daily activities. Patients who had more HFS-related hand or fingers symptoms (β = 0.440) and more HFS-related foot symptoms (β = 0.293) were more likely to have greater difficulty in overall HFS-related daily activities, with 44.7% of the variance explained. Patients with more HFS-related hand or fingers symptoms (β = 0.367) and more HFS-related foot symptoms (β = 0.302) had greater difficulty in the physical aspect of HFS-related daily activities, with 36.6% of the variance explained. Patients with more HFS-related foot symptoms (β = 0.390) and more HFS-related hand or fingers symptoms (β = 0.308) had greater difficulty in the self-care aspect of HFS-related daily activities, with 40.1% of the variance explained. Patients with more HFS-related hand or fingers symptoms (β = 0.539) had greater difficulty in the social aspect of HFS-related daily activities, with 28.2% of the variance explained. Patients with more HFS-related hand or fingers symptoms (β = 0.547) were more likely to have greater difficulty in the psychological aspect of HFS-related daily activities, with 29.0% of the variance explained (Table 5).

4. Discussion

In this study, the prevalence of toxicity grade I, II, and III of HFS were 35.5% (n = 30), 5.9% (n = 5), and 0% (n = 0) among patients with breast cancer who received docetaxel-based regimens. In a review, Degen et al. (2010) found an all-grade HFS toxicity prevalence of 89% in patients who received docetaxel combined with continuous 5-fluorouracil, and 56%–63% in patients who received docetaxel combined with capecitabine. The prevalence of HFS in our study was lower than that reported in previous studies (Degen et al., 2010; Sibaud et al., 2016). Patients in our study received an average of 3.61 cycles of chemotherapy and had not yet completed all cycles of chemotherapy. Perhaps the HFS-related symptoms were present within a few days after starting therapy and lasted for several months after beginning treatment. Healthcare providers should continue assessment of the HFS-related symptoms post-treatment.

Patients with a high grade of HFS reported more HFS-related symptoms and more HFS-related restrictions in daily activities than those who had a low grade of HFS, a finding similar to those of previous HFS studies (Mikoshiba et al., 2015; Sibaud et al., 2011). This result suggests that the clinical presentation of HFS and its impact on daily activities are highly connected to the toxicity grade of HFS. High toxicity grade HFS may cause hypersensitivity, hyperpigmentation, nail changes, erythema, and various forms of dermatitis, leading to a decline in daily activities. The findings suggest that assessment and care are needed for both the HFS-related symptoms and the conditions relative to performing daily functions.

Similar to the results of a previous study (Mikoshiba et al., 2015), we found that patients had more HFS-related foot symptoms than HFS-related hand or fingers symptoms. Cutaneous reaction of the palms of the hands and soles of the feet to docetaxel might be a result of the highly keratinized epithelial tissue of the feet. In clinical settings, healthcare providers must also pay attention to the dermatological and neurological symptoms in the feet, which could put patients at increased risk of physical inactivity.

Our major finding is that breast cancer patients who more HFS-related hand or fingers symptoms and had more HFS-related foot symptoms were more likely to report worse overall HFS-related restrictions in daily activities. This study found that HFS-related hand or fingers symptoms was the most common factor for both overall HFS- related daily activities and four aspects of HSF-related daily activities. These findings may reflect the unmet needs of cancer patients suffering from HFS (Komatsu et al., 2019). HSF in cancer patients may impact their ability to perform housework, activities of daily living, and work, as well as their level of social interaction. Healthcare providers should be aware of patients' coping strategies for HFS and provide care for their needs.

Healthcare professionals should actively assess the personal characteristics, extrinsic factors, and skin care needs of breast cancer patients with HFS, and provide patient-centered education programs in order to improve HFS-related symptoms and enhance the ability of these patients to perform as many daily activities as possible.

Table 4
Correlations among overall HFS-related daily activities, HFS-related symptoms, and selected independent variables (n = 85).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Cancer stage	1.00												
2 Number of chemotherapy cycles	−0.07	1.00											
3 Cumulative docetaxel dose	−0.24[a]	0.39[b]	1.00										
4 Time since the completion of previous chemotherapy	0.01	0.19	0.08	1.00									
5 Severity of HFS	−0.05	0.28[a]	0.45[b]	0.13	1.00								
6 Body mass index	0.20	0.01	−0.06	0.10	−0.04	1.00							
7 HFS-related foot symptoms	−0.04	−0.11	0.31[a]	0.10	0.53[b]	−0.06	1.00						
8 HFS-related hand or fingers symptoms	−0.07	−0.03	0.41[b]	0.04	0.39[b]	0.07	0.67[b]	1.00					
9 Overall HFS-daily activities	0.08	0.03	0.27[a]	0.03	0.40[b]	−0.01	0.61[b]	0.67[b]	1.00				
10 HFS-physical daily activities	0.11	0.04	0.28[a]	0.08	0.40[b]	0.04	0.51[b]	0.63[b]	0.93[c]	1.00			
11 HFS-self-care daily activities	0.01	−0.03	0.36[b]	−0.04	0.31[b]	0.04	0.48[b]	0.49[b]	0.74[c]	0.71[c]	1.00		
12 HFS-social daily activities	0.01	0.05	0.23[a]	−0.109	0.36[b]	−0.19	0.41[b]	0.42[b]	0.73[c]	0.57[b]	0.57[b]	1.00	
13 HFS- psychological daily activities	0.12	0.02	0.23[a]	0.06	0.33[b]	−0.02	0.42[b]	0.51[b]	0.77[c]	0.61[b]	0.52[b]	0.69[b]	1.00

Abbreviations:
[a] Significant at the $P < 0.05$ level (2-tailed).
[b] Significant at the $P < 0.01$ level (2-tailed).
[c] Significant at the $P < 0.001$ level (2-tailed).

Table 5
Factors significantly associated with overall HFS- related daily activities and four aspects of HSF-related daily activities based on multiple regression analysis[c] (n = 85).

Domains of HFS-daily activities	Predictive variable	coefficient	95% CI for coefficient	Adjusted R^2
Overall HFS-daily activities (HF-QoLS Scale, Hand-Foot-Quality of Life Scale)[a]	HFS-related hand or fingers symptoms	0.440	0.419–1.337	0.447
	HFS-related foot symptoms	0.293	0.122–1.019	
	Constant	−2.155	−5.763–1.452	
Physical (HF-QoLS subscale- Daily Activity subscale)[b]	HFS-related hand or fingers symptoms	0.367	0.125–0.633	0.366
	HFS-related foot symptoms	0.302	0.056–0.553	
	Constant	−0.282	−2.281–1.717	
Self-care (HF-QoLS subscale- Daily Activity subscale)[b]	HFS-related foot symptoms	0.390	0.047–0.195	0.401
	HFS-related hand or fingers symptoms	0.308	0.022–0.173	
	Constant	−0.47	−1.342 – −0.151	
Social (HF-QoLS subscale- Daily Activity subscale)[b]	HFS-related hand or fingers symptoms	0.539	0.127–0.261	0.282
	Constant	−0.289	−0.959–0.381	
Psychological (HF-QoLS subscale- Daily Activity subscale)[b]	HFS-related hand or fingers symptoms	0.547	0.207–0.419	0.290
	Constant	−0.345	−1.406–0.717	

Abbreviations:
[a] HF-QoLS Scale, Hand-Foot-Quality of Life Scale.
[b] HF-QoLS subscale- Daily Activity subscale.
[c] Independent variables: cumulative docetaxel dose (continuous score), severity of HFS (continuous score), HFS-related foot symptoms (continuous score), and HFS-related hand or fingers symptoms (continuous score).

5. Strength and limitations

This study had several limitations. First, the present study examined breast cancer patients who received at least two chemotherapy cycles, but HFS-related symptoms following chemotherapy cycles is a dynamic process that changes over time. Longitudinal or long-term follow-up studies are also needed to identify factors associated with HFS-related symptoms and HFS-related restrictions in daily activities. Second, we did not consider racial differences or skin thickness as factors in HFS-related symptoms. Thus, future studies should include individual skin status in their analysis. Finally, the humidity and temperature in the home can impact skin status, but we did not consider these factors. Comparative studies are needed to determine the effect of weather variation on HFS-related symptoms and HFS-related restrictions in daily activities among breast cancer patients.

6. Conclusions

We found that 41.2% of breast cancer patients reported HFS. Patients had higher levels of HFS-related foot symptoms than HFS-related hand or fingers symptoms. Breast cancer patients who had more HFS-related hand or fingers symptoms and more HFS-related foot symptoms were more likely to have worse HFS-related restrictions in daily activities.

Declaration of competing interest

The authors declare that they have no competing interests.

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