Research Paper

The Most Important Factor Influencing Quality of Life Among Cancer-related Psychological Symptoms

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ABSTRACT

Background: Despite progress in cancer treatment, patients often experience pain and emotional distress, which can reduce sleep quality and, ultimately, the quality of life (QoL). This study aimed to identify the most important factors influencing QoL among cancer-related psychological symptoms in patients with cancer.

Methods: This cross-sectional study with a correlational research design recruited 63 participants with cancer diagnoses from a cancer rehabilitation center in South Korea. Data were collected through convenience sampling between October 2023 and February 2024 using the following questionnaires: The European Organization for Research and Treatment of Cancer Core QoL questionnaire (EORTC QLQ-C30), consisting of 15 items to assess QoL and the breakthrough pain assessment tool (BPAT), brief fatigue inventory (BFI), Beck anxiety inventory (BAI), Beck depression inventory (BDI) and Pittsburgh sleep quality index (PSQI) to measure cancer-related psychological symptoms.

Results: Only the fatigue symptom in cancer patients was significantly correlated with all items of the EORTC QLQ-C30, whereas pain was correlated with a relatively small number (five items) of EORTC QLQ-C30 items compared to other psychological symptoms. Additionally, there were moderate to strong correlations between cancer-related pain, fatigue, anxiety, depression and poor sleep quality.

Conclusion: Cancer-related psychological symptoms were interrelated, and these symptoms were related to the multidimensional components of QoL. Fatigue was the most important factor influencing the overall QoL. We suggest that healthcare professionals consider a comprehensive approach to improving the QoL of patients with cancer.

Keywords: Pain, Fatigue, Depression, Sleep quality, Quality of life (QoL), Cancer

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Introduction

Cancer diagnosis and adverse effects of treatment affect quality of life (QoL). Patients with cancer have an average of 11–13 psychological symptoms (pain and emotional disturbance) simultaneously, and this number may be significantly higher in patients with advanced disease [1]. Despite progress in cancer treatment, patients often experience individual elements of this psychological symptom cluster, which can ultimately reduce their QoL [2].

Psychological symptom clusters, such as pain, fatigue, anxiety, depression, and poor sleep quality are experienced and challenged by a large number of cancer patients. The prevalence of pain was 39.3% among cancer survivors after curative treatment, 55.0% during anticancer therapy and 66.4% for those with metastatic or terminal disease. Regardless of the cancer stage, 51% of all patients experience pain, with 38.0% describing it as moderate to severe [3]. In terms of fatigue, 9–45% of cancer patients experience moderate-to-severe fatigue during treatment, which in severe cases, may lead to treatment discontinuation [4, 5]. Up to 38% of cancer survivors also have clinically significant levels of anxiety and depressive symptoms in the first five years after diagnosis [6]. For instance, the prevalence of anxiety and depression in breast cancer patients is 41.9% and 32.2%, respectively [7, 8]. Sleep disturbances, such as hypersomnia, short sleep duration, sleep apnea, and insomnia have been reported to occur in approximately 50% of patients with cancer. These disruptions are linked to reduced physical functioning and emotional states, including depression and distress. Moreover, poor sleep quality is associated with high levels of anxiety and depression [9, 10]. Similar to these findings, psychological symptoms are interrelated and negatively affect patients' QoL [11].

Several studies have investigated the relationship between cancer-related psychological symptoms and their individual impact on QoL, highlighting the interrelated nature of these symptoms. Liu et al. examined the relationship among pain severity, fatigue severity, and QoL in patients with cancer. Most patients reporting mild pain generally experience mild fatigue, and their QoL tends to be moderate, whereas patients with moderate and severe pain typically experience moderate-to-severe fatigue and low QoL. A negative relationship was reported between fatigue and QoL in patients with moderate to severe pain [2]. Papadopoulou et al. investigated the relationship between distress, anxiety, depression and QoL in ambulatory patients with cancer receiving chemotherapy. The hospital anxiety and depression scale (HADS)-anxiety is significantly correlated with almost all items of the European Organization for Research and Treatment of Cancer Core QoL questionnaire (EORTC QLQ-C30) and HADS-Depression is significantly correlated with all items of the EORTC QLQ-C30 [12]. Alwhaibi et al. demonstrated that patients with cancer who have both anxiety and depression symptoms have the lowest mean scores in the physical and mental domains of health-related QoL (HRQoL). Additionally, patients with cancer who had anxiety and depression were more likely to have lower mental component scores for HRQoL than those with cancer alone [13]. Hofmeister et al. demonstrated a negative relationship between sleep quality and the general QoL in patients with cancer. Female cancer patients reported significantly more sleep problems than male patients, and younger cancer patients reported more sleep problems than older patients [14].

As defined by the World Health Organization (WHO), QoL is a multifaceted concept (multidimensional construct) that integrates an individual's physical health, psychological state, level of independence, social relationships, personal beliefs, and relationships with key aspects of their environment in a complex manner [15]. By studying the relationships between the multidimensional components of the EORTC QLQ-C30 and psychological symptom clusters, specific and in-depth correlations with QoL according to each cancer-related psychological symptom could be identified. Several studies have investigated the relationship between cancer-related psychological symptoms and their impact on QoL [2, 12-14, 16]. Despite these findings, there is a gap in the literature regarding the specific relationship between cancer-related psychological symptoms and QoL. Moreover, various studies have shown that the interaction between cancer-related psychological symptoms and QoL is complex. To address this gap in the literature, understand these complex interrelationships, and determine considerations when planning interventions in cancer rehabilitation, we investigated the relationship between cancer-related psychological symptoms, including all major symptoms, and the 15 items of the EORTC QLQ-C30.

Understanding these intricate relationships is crucial for developing targeted interventions to improve the QoL of patients with cancer. Therefore, this study aimed to fill this gap by examining the associations between various cancer-related psychological symptoms and the different components of the EORTC QLQ-C30 in patients with cancer. By identifying the most significant factors influencing QoL among these cancer-related psychological

symptoms, this study sought to provide valuable insights for the development of tailored interventions to enhance the well-being of individuals with cancer. Additionally, this study aimed to understand the interrelationships between different psychological symptoms such as anxiety, depression, fatigue, and poor sleep quality.

Methods

Research design

This cross-sectional study employed a correlational research design.

Participants

A total of 63 participants with a cancer diagnosis (47 women; mean age: 57.5±8.9 years) were recruited from a cancer rehabilitation center in Daejeon, South Korea. All participants were recruited using a convenience sampling approach between October 2023 and February 2024. The minimum sample size for correlation analysis was determined according to the calculation method by Hulley et al. [17] (Equation 1).

1. $(N=[(Z\alpha+Z\beta)/C]^2+3)$

The power (1-β) and expected correlation coefficient (r) were determined based on existing correlation analyses [18]. This was derived by inserting the values of α (two-tailed) (0.05), power (0.95) or β (0.05) and expected correlation coefficient (0.50), resulting in a final calculation of 46 subjects. A total of 69 individuals were recruited for this study, accounting for potential dropouts. Of these, six who did not meet the inclusion criteria were excluded and 63 cases ultimately participated in this study. The inclusion criteria were as follows: 1) Age ranging from 30 to 70 years with a known cancer diagnosis; 2) Currently undergoing surgery, chemotherapy, or radiotherapy; 3) Ability to communicate and participate in a survey; and 4) No diagnosis of other psychological or neurological disorders. The demographic and clinical characteristics of the participants are shown in Table 1. All participants were provided with information about the purpose of the study and its procedures, expected results and management of personal information. Written informed consent was obtained from all participants prior to the study. All cancer patients who participated in this study evaluated their psychological symptoms (pain, fatigue, anxiety, depression and poor sleep quality) and QoL using clinical measurement tools.

Data collection

EORTC core QoL questionnaire (EORTC QLQ-C30)

The EORTC QLQ-C30 was used to measure the physical, psychological, and social functioning of patients with cancer. The questionnaire comprised nine multi-item scales, including a global QoL scale, five functioning scales (physical, role, cognitive, emotional and social) and three symptom scales (fatigue, pain, and nausea/vomiting). In addition, it includes six items, including dyspnea, loss of appetite, constipation, diarrhe, and financial difficulties. For the global QoL scale, the two items utilized a modified seven-point linear analog scale. Items comprising the physical and role functioning scales used “yes or no” responses. All other items were scored on a 4-point categorical scale ranging from 1 (“not at all”) to 4 (“very much”). All scales and single items were converted linearly into a scale of 0–100 points. For the global QoL scale and five functioning scales, higher scores indicated better functioning. Also, higher scores on symptom scales (e.g. fatigue, pain, nausea/vomiting, dyspnea, loss of appetite) and items indicated greater symptom severity [19]. In this study, the internal consistency (Cronbach’s α) of this questionnaire was 0.82 for all items. The reliability and validity of the Korean version of the EORTC QLQ-C30 (EORTC QLQ-C30-K) were established in a previous study involving 170 patients. The EORTC QLQ-C30-K demonstrated a good reliability coefficient for multiple-item scales, ranging from 0.6 (cognitive functioning) to 0.87 (physical and role functioning). The EORTC QLQ-C30-K was correlated significantly with the cognitive-affective and somatic scales of the Beck depression inventory (BDI) (Pearson’s correlation coefficient, r=-0.42 to 0.69) and the pain severity and pain interference scales of the brief pain inventory (r=-0.27 to 0.69) [20].

Breakthrough pain assessment tool (BPAT)

The BPAT is designed to clinically assess breakthrough pain in cancer patients and consists of 14 items, including nine questions related to pain and five questions related to pain treatment. Our study used the result of the item “typical episodes of pain,” which indicates the general level of pain. The pain-related items were measured using an 11-point numerical rating scale (NRS), with zero indicating “no pain” and ten indicating “pain as bad as you can imagine or serious interference in normal living” [21]. Shin et al. demonstrated excellent internal consistency (Cronbach’s α=0.74) and high test retest reliability (0.78) for the Korean version of the BPAT

(BPAT-K). Additionally, in a validity study, the "typical episodes of pain" scale of the BPAT-K was significantly (r=0.55) correlated with the "average pain" scale of the brief pain inventory in patients with cancer [22].

Brief fatigue inventory (BFI)

The BFI comprises nine items designed to determine whether a patient felt fatigued during the past week. It includes three questions to assess fatigue and six questions to identify fatigue-related interference, such as general activity, mood, walking, normal tasks, relationships with others, and enjoyment of life. Fatigue measures assessed patients' fatigue intensity and interference using an 11-point NRS. In terms of fatigue intensity, a score of 0 indicated "no fatigue," while a score of 10 indicated "fatigue as bad as you can imagine." The fatigue-related interference scores range from zero, indicating "does not interfere," to ten, signifying "completely interferes." The total score was obtained by averaging all nine items, ranging from zero to ten. Higher scores indicated greater fatigue and interference in daily life [23]. The internal consistency in this study was assessed by a Cronbach's α of 0.87. The reliability of the BFI-Korean version (BFI-K) has been previously established with a Cronbach's α coefficient of 0.96 in individuals with cancer. For the concurrent validity of the BFI-K, the total score and each score of all nine items showed high correlations (r=0.50–0.66) with the fatigue sub-item of the EORTC QLQ-C30 [24].

Beck anxiety inventory (BAI)

The BAI is a 21-item questionnaire rated on a Likert scale that measures the level of anxiety symptoms in adults. Each item contained a list of four statements arranged in order of increasing severity of specific symptoms of anxiety. Each item is rated from 0 ("not at all") to 3 ("severe"). Anxiety levels were scored using the following ordinal categories: 0–21, normal; 22–26, mild disturbance; 27–31, moderate disturbance; and 32–63, severe disturbance [25]. In this study, the Cronbach's α coefficient for the questionnaire was 0.83, indicating high internal consistency. The Korean version of the BAI (BAI-K) was highly correlated with the seven-item generalized anxiety disorder 7-item scale (r=0.776) and anxiety sensitivity index-3 (r=0.724), indicating good convergent validity [26].

BDI

The BDI is a self-administered survey consisting of 21 items that measure characteristic attitudes and symptoms of depression. Each item is scored on a four-point Likert scale ranging from zero to three. Depression levels were scored using the following ordinal categories: 0–13: Minimal or no depression, 14–19: Mild depression, 20–28: Moderate depression, and 29–63: Severe depression [27]. The internal consistency was assessed by Cronbach's α of 0.89 in this study. According to previous studies, the BAI-K has good overall internal consistency (Cronbach's α=0.88) and test re-test reliability (0.6). The BAI-K showed significantly positive convergent validity with the geriatric depression scale (r=0.59) in an elderly Korean population [28].

Pittsburgh sleep quality index (PSQI)

The PSQI is a subjective evaluation tool for measuring sleep quality over a one-month period. It consists of 19 questions in seven categories, including sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. A total score and seven category scores were obtained from the scale, but only the total score was used for statistical analysis in this study. Each component was scored on a 0–3-point scale, with the total score ranging from 0 to 21 [29]. Higher scores indicate poorer sleep quality. In this study, the PSQI exhibited high internal consistency (Cronbach's α=0.82). According to a previous study, the Korean version of the PSQI has high internal consistency (Cronbach's α=0.84) and test–re-test reliability (r=0.65) [30]. It also has good validity compared to Fitbit sleep parameters, offering a practical screening tool for identifying sleep disorders in Korean adults [31].

Data analysis

Descriptive statistics were presented as means and standard deviations. The assumption of a normal distribution of the dependent variable was confirmed using the Shapiro–Wilk test. Pearson's product correlation coefficient (r) was used to analyze the correlations between the 15 items of the EORTC QLQ-C30 (QoL) and each cancer-related psychological symptom (pain, fatigue, anxiety, depression, and poor sleep quality). Additionally, a correlation analysis (r) was used to evaluate the interrelations between cancer-related psychological symptoms. The interpretation of r values was as follows: 0.70–1: A very strong or strong correlation, 0.40–0.69: Moderate correlation, 0.10–0.39: A weak correlation and <0.10: Negligible [32]. All statistical analyses were completed using SPSS software, version 23, with the statistical significance level (α) set at 0.05.

Table 1. Demographic and clinical characteristics of participants (n=63)

Variables		Mean±SD/No. (%)
Age (y)		57.5±8.9
Height (cm)		161.2±7.3
Weight (kg)		56.6±8.3
Gender	Male	16(25.4)
	Female	47(74.6)
Time since cancer diagnosis (months)		28.8±26.3
Cancer type[a]	Breast cancer	21(33.3)
	Gynecologic cancer	9(14.3)
	Colorectal cancer	10(15.9)
	Lung cancer	11(17.5)
	Gastric cancer	5(7.9)
	Other cancers	10(15.9)
Treatment[b]	Surgery	50(73.4)
	Chemotherapy	39(61.9)
	Radiation therapy	19(30.2)

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[a]Some patients had more than one type of cancer, [b]Some patients received more than one treatment depending on their health condition.

Results

Table 1 presents the demographic and clinical characteristics of the participants. The mean age, height and weight were 57.5±8.9 years, 161.2±7.3 cm and 56.6±8.3 kg, respectively. Among the total 63 participants, males accounted for 25.4%, and females accounted for the majority at 74.6%. The duration of cancer diagnosis was 28.8±26.3 months. Breast cancer was the most common cancer type (21 participants, 33.3%), followed by lung cancer (11 participants, 17.5%). The percentage of participants who underwent surgery was 73.4% and 61.9% and 30.2% of the patients received chemotherapy and radiotherapy, respectively (Table 1).

Table 2 presents the relationships between the 15 items of the EORTC QLQ-C30 measuring QoL and cancer-related psychological symptoms, including pain BPAT, fatigue BFI, anxiety BAI, depression BDI and poor sleep quality (PSQI) in persons with cancer. First, the BPAT was significantly associated with physical, role, and emotional functioning (r=-0.305 to -0.418), fatigue (r=0.467) and pain (r=0.368) scales among the EORTC QLQ-C30 items. The BFI was negatively (r=-0.370 to -0.801) or positively (r=0.334 to 0.738) correlated with all items of the EORTC QLQ-C30. The BAI was either negatively (r=-0.475 to -0.606) or positively (r=0.314 to 0.632) correlated with 13 items of the EORTC QLQ-C30, except for the global health status/QoL and nausea/vomiting items. The BDI revealed significant relationships in the correlation analysis with the multi-item scales of five functioning scales (r=-0.375 to -0.605), fatigue and pain symptom scales (r=0.505 and 0.313), and four single items (dyspnea, r=0.482; insomnia, r=0.346; appetite loss, r=0.535 and financial difficulties, r=0.424). Furthermore, there were either negative (r=-0.405 to -0.540) or positive (r=0.382 to 0.547) associations between the PSQI and most of the 12 items of the EORTC QLQ-C30, excluding global health status/QoL, constipation, and diarrhea. According to these results, all significant relationships between the 15 items of the EORTC QLQ-C30 and the cancer-related psychological symptom cluster were moderate (Table 2).

Table 2. Correlations between the 15 items of the EORTC QLQ-C30 and cancer-related psychological symptoms

EORTC QLQ-C30 Items	BPAT	BFI	BAI	BDI	PSQI
Global health status/QoL	-0.112	-0.37*	-0.129	-0.037	-0.143
Physical functioning	-0.418**	-0.801**	-0.523**	-0.501**	-0.507**
Role functioning	-0.383*	-0.593**	-0.524**	-0.375*	-0.475**
Emotional functioning	-0.305*	-0.493**	-0.565**	-0.605**	-0.54**
Cognitive functioning	-0.259	-0.574**	-0.606**	-0.53**	-0.405**
Social functioning	-0.274	-0.65**	-0.475**	-0.386**	-0.497**
Fatigue	0.467**	0.738**	0.632**	0.505**	0.528**
Nausea/Vomiting	-0.054	0.334*	0.292	0.197	0.445**
Pain	0.368*	0.581**	0.372*	0.313*	0.504**
Dyspnea	0.222	0.396**	0.617**	0.482**	0.379*
Insomnia	0.279	0.589**	0.315*	0.346*	0.547**
Appetite loss	0.175	0.614**	0.431**	0.535**	0.42**
Constipation	0.019	0.394**	0.314*	0.176	0.28
Diarrhea	-0.055	0.336*	0.409**	0.227	0.247
Financial difficulties	0.288	0.424**	0.34*	0.424**	0.382*

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Abbreviations: EORTC QLQ-C30: European organization for research and treatment of cancer core quality of life questionnaire; QoL: Quality of life; BPAT: Breakthrough pain assessment tool; BFI: Brief fatigue inventory; BAI: Beck anxiety inventory; BDI: Beck depression inventory; PSQI: Pittsburgh sleep quality index.

Notes: Data are the Pearson's correlation coefficient (r) values. *P<0.05, **P<0.01.

Table 3 shows the results of the interrelationships between pain, fatigue, anxiety, depression and poor sleep quality. Among cancer-related psychological symptoms, the BPAT was moderately correlated with the BFI (r=0.490), BAI (r=0.511), BDI (r=0.531), and PSQI (r=0.416) in cases with cancer (Table 3). The BFI was significantly associated with the BAI (r=0.610), BDI (r=0.472), and PSQI (r=0.550), indicating moderate correlations. The relationship between the BAI and BDI revealed a strong correlation (r=0.741). Finally, the PSQI had moderate correlations with the BAI (r=0.588) and BDI (r=0.514) in cases with cancer. All cancer-related psychological symptoms, including pain, fatigue, anxiety, depression and poor sleep quality were closely interrelated with each other in cases with cancer (Table 3).

Discussion

This study aimed to determine the relationships between the 15 items of the EORTC QLQ-C30 (measuring QoL) and cancer-related psychological symptoms, including pain, fatigue, anxiety, depression and poor sleep quality (measured by the BPAT, BFI, BAI, BDI, and PSQI, respectively), in patients with cancer. The relationship between cancer and psychological symptoms was also examined.

Regarding the correlations between the 15 items of the EORTC QLQ-C3 and each cancer-related psychological symptom in this study, pain symptoms showed moderate correlations with the physical functioning and fatigue items of the EORTC QLQ-C3. This result is supported by that of a previous study. Liu et al. demonstrated that fatigue was significantly correlated with QoL in patients experiencing moderate and severe pain, whereas there was no correlation with QoL in patients with cancer

Table 3. Correlations between pain, fatigue, anxiety, depression, and poor sleep quality

Variables	BPAT	BFI	BAI	BDI	PSQI
BPAT	1	0.49**	0.511**	0.531**	0.416**
BFI	-	1	0.61**	0.472**	0.55**
BAI	-	-	1	0.741**	0.588**
BDI	-	-	-	1	0.514**
PSQI	-	-	-	-	1

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Abbreviations: BPAT: Breakthrough pain assessment tool; BFI: Brief fatigue inventory; BAI: Beck anxiety inventory; BDI: Beck depression inventory; PSQI: Pittsburgh sleep quality index.

Notes: Data are Pearson's correlation coefficient (r) values. **P<0.01.

experiencing mild pain. In other words, cancer patients experiencing moderate and severe pain also experience more fatigue symptoms and lower QoL than those experiencing mild pain [2]. Based on these results, we suggest that patients with cancer experiencing high levels of pain experience severe fatigue, leading to problems with physical function and ultimately reducing their QoL. A multivariate analysis demonstrated that pain was the strongest predictor of fatigue, which is consistent with the results of our study [33].

Second, fatigue was negatively or positively correlated with all items of the EORTC QLQ-C30, with the physical functioning item showing the strongest association. Canário et al. determined the relationships between levels of physical activity, fatigue, and QoL in 215 women with breast cancer. Most women felt fatigued (72.09%), and physically active women had fewer symptoms of fatigue. Women with fatigue had a significantly lower mean QoL score. More physically active women scored higher on overall QoL (EORTC QLQ-30) scales, especially functional capacity, than sedentary patients [34]. These findings on fatigue symptoms suggest that engaging in physical activity to improve physical function can reduce fatigue, ultimately improve overall QoL and highlight the importance of fatigue management through physical activity during cancer rehabilitation.

Third, anxiety was significantly associated with 13 items of the EORTC QLQ-C30, excluding global health status/QoL and nausea/vomiting, whereas depression was correlated with 11 items of the EORTC QLQ-C30, excluding global health status/QoL, nausea/vomiting, constipation, and diarrhea. We hypothesized that the lack of significant correlations with digestive system symptoms such as nausea/vomiting, constipation and diarrhea may be due to the participation of cancer patients with minimal depression in this study. However, these findings are consistent with those of a previous study. Papadopoulou et al. found that the HADS-anxiety was significantly associated with almost all items of the EORTC QLQ-C30 (r=-0.660 [emotional functioning] to r=0.536 [fatigue]), except for diarrhea. HADS-Depression (r=-0.757 [emotional functioning] to r=0.709 [fatigue]) was significantly related to all items of the EORTC QLQ-C30 [12]. Anxiety and depression symptoms showed the highest correlation with the fatigue and emotional functioning items of the EORTC QLQ-C30. Karakoyun-Celik et al. investigated the relationship between anxiety, depression, and QoL in women undergoing follow-up breast cancer treatment. Among the QoL evaluation tools (EORTC QLQ-C30 and QLQ-BR23 for patients with breast cancer), difficulty sleeping, emotional state, fatigue, and body appearance are related to anxiety and depression in patients with breast cancer [35]. In another previous study, significant negative correlations were found between the emotional functioning sub-item of the EORTC QLQ-C30 and items of the HADS (anxiety: r=-0.62; depression: r=-0.54) in patients with gastrointestinal cancer [36]. A meta-analysis by Seo et al. found that both depression and anxiety were significantly associated with fatigue, with higher levels of anxiety and depression being associated with higher levels of fatigue [37]. Based on these findings, we propose that depression and anxiety are closely associated with a wide range of QoL factors, such as physical health, psychological state, level of independence and social relationships. Anxiety and depression can interfere with treatment adherence and the ability to cope with cancer, which, in turn, can worsen cancer progression. Therefore, depression and anxiety may contribute to reduced QoL in patients with cancer.

Finally, poor sleep quality measured by the PSQI in patients with cancer was correlated with 12 items of the EORTC QLQ-C30, except for global health status/QoL, constipation, and diarrhea. Our results are consistent with those of previous studies on poor sleep quality in cancer patients. Hofmeister et al. investigated the relationships between sleep-related items and other items of the EORTC QLQ-C30 in patients with cancer and found that poor sleep quality was highly correlated with fatigue and emotional functioning [14]. Ho et al. also reported that women with breast cancer exhibited significant correlations between depression, fatigue and sleep disturbances in pre-, post-, and 6-to 8-week follow-up tests for adjuvant chemotherapy [38]. In this study, poor sleep quality was strongly correlated with insomnia, emotional functioning, and fatigue. There is a complex relationship between sleep problems and mood states. Sleep problems can lead to psychological disorders, such as depression, anxiety, and emotional changes, which can interfere with sleep [39]. Various factors associated with cancer treatment, including physical symptoms, fatigue, anxiety, and other psychological symptoms contribute to poor sleep quality in patients with cancer [40].

Based on our findings, we identified two important clinical implications. This study found moderate to strong correlations between cancer-related pain, fatigue, anxiety, depression, and poor sleep quality. Cancer-related pain, fatigue, anxiety, depression and sleep disturbances coexist in symptom clusters in individuals with cancer. This may interfere with the patient's ability to cope with the burden of the disease, reduce treatment acceptability, prolong hospital stay and reduce QoL. This study demonstrated that cancer-related psychological symptoms were interrelated and these psychological symptoms were significantly correlated with multidimensional components of QoL. Importantly, among cancer-related psychological symptoms, fatigue showed significant correlations with all items of the EORTC QLQ-C3; thus, fatigue appears to be the most important factor influencing overall QoL. Therefore, to improve QoL during cancer rehabilitation, establishing a treatment plan that takes a multidisciplinary or comprehensive approach to addressing cancer-related psychological symptoms is recommended. Next, our results showed that the BPAT, BFI, BAI, BDI and PSQI in patients with cancer were significantly associated with pain, fatigue, emotional functioning, and insomnia items of the EORTC QLQ-C30. In practice, it is feasible to use items from the EORTC QLQ-C30 to identify symptoms such as pain, fatigue, anxiety, depression and poor sleep quality, which may shorten the assessment time for patients with cancer.

Although our study yielded meaningful findings, it has several limitations. First, the self-recorded results of all measurement tools were subjective and may have been affected by the memory bias, communication and comprehension abilities of the participants. We propose to compensate for this limitation using scientific and objective assessment tools, such as electroencephalography (EEG), which measures the brain's electrical activation. Second, data were collected by only two examiners. Future studies should consider recruiting several well-trained examiners to blind the data between measurements. Finally, the participants in this study had various cancer types, such as breast, gynecological, colorectal, lung, and gastric cancers, and only Koreans were included. Hence, we recommend additional studies with larger samples across cancer types and countries to generalize these data. Notwithstanding the above limitations, our results revealed that fatigue is the most important factor influencing QoL among cancer-related psychological symptoms and the EORTC QLQ-C30 is a useful tool because it not only assesses QoL but also cancer-related psychological symptoms.

Conclusion

Cancer diagnosis and the adverse effects of treatment lead to various cancer-related psychological symptoms that affect QoL. Our study aimed to determine the relationship between the 15 sub-items of the EORTC QLQ-C30 (measuring QoL) and psychological symptoms, including pain, fatigue, anxiety, depression, and poor sleep quality, in patients with cancer. In summary, we found that cancer-related psychological symptoms were interrelated and correlated with multidimensional components of QoL, including physical, psychological, and social functioning. In particular, fatigue is the most important factor affecting QoL, suggesting that interventions targeting fatigue management in patients with cancer may be effective in improving the overall QoL. It is important to maintain a balanced perspective without overlooking the complex interrelationships between the various symptoms and factors affecting the QoL of cancer patients. Therefore, healthcare professionals should consider a multidisciplinary team approach that addresses both the physical and psychological symptoms to improve the QoL of patients with cancer.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Ethics Committee of the Institutional Review Board of Kwangju Women's University (Code: 1041465-202403-HR-001-05) and conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all study subjects for voluntary participation before they took part in the study.

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Authors' contributions

Conceptualization and investigation: Byeongkwan Kim; Formal analysis: Namgi Lee; Writing the original draft: Namgi Lee; Methodology, data curation, review, editing and final approval: All authors.

Conflict of interest

The authors declared no conflict of interest.

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References

[1] Guimond AJ, Ivers H, Savard J. Clusters of psychological symptoms in breast cancer: Is there a common psychological mechanism? Cancer Nursing. 2020; 43(5):343-53. DOI:10.1097/NCC.0000000000000705]

[2] Liu D, Weng JS, Ke X, Wu XY, Huang ST. The relationship between cancer-related fatigue, quality of life and pain among cancer patients. International Journal of Nursing Sciences. 2023; 10(1):111-6. [DOI:10.1016/j.ijnss.2022.12.006]

[3] Van Den Beuken-Van MH, Hochstenbach LM, Joosten EA, Tjan-Heijnen VC, Janssen DJ. Update on prevalence of pain in patients with cancer: Systematic review and meta-analysis. Journal of Pain and Symptom Management. 2016; 51(6):1070-90. [DOI:10.1016/j.jpainsymman.2015.12.340]

[4] Roila F, Fumi G, Ruggeri B, Antonuzzo A, Ripamonti C, Fatigoni S, et al. Prevalence, characteristics, and treatment of fatigue in oncological cancer patients in Italy: A cross-sectional study of the Italian network for supportive care in Cancer (NICSO). Supportive Care in Cancer. 2019; 27:1041-7. [DOI:10.1007/s00520-018-4393-9]

[5] Wang XS, Zhao F, Fisch MJ, O'Mara AM, Cella D, Mendoza TR, et al. Prevalence and characteristics of moderate to severe fatigue: A multicenter study in cancer patients and survivors. Cancer. 2014; 120(3):425-32. [DOI:10.1002/cncr.28434]

[6] Hoffman KE, McCarthy EP, Recklitis CJ, Ng AK. Psychological distress in long-term survivors of adult-onset cancer: Results from a national survey. Archives of Internal Medicine. 2009; 169(14):1274-81. [DOI:10.1001/archinternmed.2009.179]

[7] Pilevarzadeh M, Amirshahi M, Afsargharehbagh R, Rafiemanesh H, Hashemi S-M, Balouchi A. Global prevalence of depression among breast cancer patients: A systematic review and meta-analysis. Breast Cancer Research and Treatment. 2019; 176:519-33. [DOI:10.1007/s10549-019-05271-3]

[8] Hashemi SM, Rafiemanesh H, Aghamohammadi T, Badakhsh M, Amirshahi M, Sari M, et al. Prevalence of anxiety among breast cancer patients: A systematic review and meta-analysis. Breast Cancer. 2020; 27:166-78. [DOI:10.1007/s12282-019-01031-9]

[9] İzci F, İlgün AS, Fındıklı E, Özmen V. Psychiatric symptoms and psychosocial problems in patients with breast cancer. The Journal of Breast Health. 2016; 12(3):94-101. [DOI:10.5152/tjbh.2016.3041] [PMID]

[10] Cho OH, Hwang KH. Association between sleep quality, anxiety and depression among Korean breast cancer survivors. Nursing Open. 2021; 8(3):1030-7. [DOI:10.1002/nop2.710]

[11] Fiorentino L, Rissling M, Liu L, Ancoli-Israel S. The symptom cluster of sleep, fatigue and depressive symptoms in breast cancer patients: Severity of the problem and treatment options. Drug Discovery Today. 2011; 8(4):167-73. [DOI:10.1016/j.ddmod.2011.05.001]

[12] Papadopoulou A, Govina O, Tsatsou I, Mantzorou M, Mantoudi A, Tsiou C, et al. Quality of life, distress, anxiety and depression of ambulatory cancer patients receiving chemotherapy. Medicine and Pharmacy Reports. 2022; 95(4):418. [DOI:10.15386/mpr-2458]

[13] Alwhaibi M, AlRuthia Y, Sales I. The impact of depression and anxiety on adult cancer patients' health-related quality of life. Journal of Clinical Medicine. 2023; 12(6):2196. [DOI:10.3390/jcm12062196]

[14] Hofmeister D, Schulte T, Mehnert-Theuerkauf A, Geue K, Zenger M, Esser P, et al. The association between sleep problems and general quality of life in cancer patients and in the general population. Frontiers in Psychology. 2022; 13:960029. [DOI:10.3389/fpsyg.2022.960029]

[15] Group W. The World Health Organization quality of life assessment (WHOQOL): Position paper from the World Health Organization. Social Science & Medicine. 1995; 41(10):1403-9. [DOI:10.1016/0277-9536(95)00112-K]

[16] So WK, Marsh G, Ling WM, Leung FY, Lo JC, Yeung M, et al. The symptom cluster of fatigue, pain, anxiety, and depression and the effect on the quality of life of women receiving treatment for breast cancer: A multicenter study. Oncology Nursing Forum. 2009; 36(4):E205-14. [DOI:10.1188/09.ONF.E205-E214]

[17] Hulley SB, Cummings SR, Browner WS, Grady DG, Newman T, Gaertner R. Designing clinical research: An epidemiologic approach. Philadelphia: Lippincott Williams & Wilkins; 2013. [Link]

[18] Lee NG, Kang TW, Park HJ. Relationship between balance, gait, and activities of daily living in older adults with dementia. Geriatric Orthopaedic Surgery & Rehabilitation. 2020; 11:2151459320929578. [DOI:10.1177/2151459320929578]

[19] Bedard G, Zeng L, Zhang L, Lauzon N, Holden L, Tsao M, et al. Minimal important differences in the EORTC QLQ-C30 in patients with advanced cancer. Asia Pacific Journal of Clinical Oncology. 2014; 10(2):109-17. [DOI:10.1111/ajco.12070]

[20] Yun YH, Park YS, Lee ES, Bang SM, Heo D, Park S, et al. Validation of the Korean version of the EORTC QLQ-C30. Quality of Life Research. 2004; 13:863-8. [DOI:10.1023/B:QURE.0000021692.81214.70]

[21] Webber K. Development of the breakthrough pain assessment tool (BAT) in cancer patients. International Journal of Palliative Nursing. 2014; 20(9):424. [DOI:10.12968/ijpn.2014.20.9.424]

[22] Shin J, Cho SJ, Lee J, Choi YS. Validation of the Korean version of the breakthrough pain assessment tool in cancer patients. Journal of Pain and Symptom Management. 2017; 54(3):361-7. [DOI:10.1016/j.jpainsymman.2017.07.011]

[23] Lu Y, Qu HQ, Chen FY, Li XT, Cai L, Chen S, et al. Effect of Baduanjin Qigong exercise on cancer-related fatigue in patients with colorectal cancer undergoing chemotherapy: A randomized controlled trial. Oncology Research and Treatment. 2019; 42(9):431-9. [DOI:10.1159/000501127]

[24] Yun YH, Wang XS, Lee JS, Roh JW, Lee CG, Lee WS, et al. Validation study of the Korean version of the brief fatigue inventory. Journal of Pain and Symptom Management. 2005; 29(2):165-72. [DOI:10.1016/j.jpainsymman.2004.04.013]

[25] Yook SP, Kim Z. A clinical study on the Korean version of Beck Anxiety Inventory: Comparative study of patient and non-patient. Korean J Clin Psychol. 1997; 16(1):185-97. [Link]

[26] Oh H, Park K, Yoon S, Kim Y, Lee SH, Choi YY, et al. Clinical utility of Beck Anxiety Inventory in clinical and nonclinical Korean samples. Frontiers in Psychiatry. 2018; 9:426408. [DOI:10.3389/fpsyt.2018.00666]

[27] Jackson-Koku G. Beck depression inventory. Occupational Medicine. 2016; 66(2):174-5. [DOI:10.1093/occmed/kqv087]

[28] Jo SA, Park MH, Jo I, Ryu SH, Han C. Usefulness of beck depression inventory (BDI) in the Korean elderly population. International Journal of Geriatric Psychiatry. 2007; 22(3):218-23. [DOI:10.1002/gps.1664]

[29] Momayyezi M, Fallahzadeh H, Farzaneh F, Momayyezi M. Sleep quality and cancer-related fatigue in patients with cancer. Journal of Caring Sciences. 2021;10(3):145. [DOI:10.34172/jcs.2021.021] [PMID]

[30] Sohn SI, Kim DH, Lee MY, Cho YW. The reliability and validity of the Korean version of the pittsburgh sleep quality index. Sleep and Breathing. 2012; 16:803-12. [DOI:10.1007/s11325-011-0579-9]

[31] Lee SY, Choi JE, Lee JW, Lee Y, Park JM, Hong KW. Testing the reliability and validity of the korean version of the pittsburgh sleep quality index using fitbit devices: A cross-sectional analysis. Journal of the Korean Academy of Family Medicine. 2024; kjfm.23.0166. [DOI:10.4082/kjfm.23.0166] [PMID]

[32] Schober P, Boer C, Schwarte LA. Correlation coefficients: Appropriate use and interpretation. Anesthesia & Analgesia. 2018; 126(5):1763-8. [DOI:10.1213/ANE.0000000000002864]

[33] Bower JE, Ganz PA, Desmond KA, Rowland JH, Meyerowitz BE, Belin TR. Fatigue in breast cancer survivors: Occurrence, correlates, and impact on quality of life. Journal of Clinical Oncology. 2000; 18(4):743-53. [DOI:10.1200/JCO.2000.18.4.743]

[34] Canário ACG, Cabral PUL, Paiva LCd, Florencio GLD, Spyrides MH, Gonçalves AKdS. Physical activity, fatigue and quality of life in breast cancer patients. Revista da Associação Médica Brasileira. 2016; 62(1):38-44. [DOI:10.1590/1806-9282.62.01.38]

[35] Karakoyun-Celik O, Gorken I, Sahin S, Orcin E, Alanyali H, Kinay M. Depression and anxiety levels in woman under follow-up for breast cancer: Relationship to coping with cancer and quality of life. Medical oncology. 2010; 27:108-13. [DOI:10.1007/s12032-009-9181-4]

[36] Tavoli A, Tavoli Z, Montazeri A. The relationship between emotional functioning of the EORTC QLQ-C30 and a measure of anxiety and depression (HADS) in cancer patients. International Journal of Cancer Management. 2019; 12(7):e94568. [DOI:10.5812/ijcm.94568]

[37] Seo YM, Oh HS, Seo WS, Kim HS. Comprehensive predictors of fatigue for cancer patients. Journal of Korean Academy of Nursing. 2006; 36(7):1224-31. [DOI:10.4040/jkan.2006.36.7.1224]

[38] Ho SY, Rohan KJ, Parent J, Tager FA, McKinley PS. A longitudinal study of depression, fatigue, and sleep disturbances as a symptom cluster in women with breast cancer. Journal of Pain and Symptom Management. 2015; 49(4):707-15. [DOI:10.1016/j.jpainsymman.2014.09.009]

[39] Shorofi SA, Nozari-Mirarkolaei F, Arbon P, Bagheri-Nesamie M. Depression and sleep quality among iranian women with breast cancer. Asian Pacific Journal of Cancer Prevention. 2021; 22(11):3433. [DOI:10.31557/APJCP.2021.22.11.3433]

[40] Matthews EE, Wang SY. Cancer-related sleep wake disturbances. Seminars in Oncology Nursing. 2022; 38(1):151253. [DOI:10.1016/j.soncn.2022.151253]