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Research Article

Quality of Sleep and Related Factors in Patients with Esophageal Cancer

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Abstract

Background: Insomnia is one of the most common problems faced by cancer patients, with approximately 50% of patients experiencing it. Esophageal cancer is the most aggressive and deadly cancer of the digestive system. Patients with esophageal cancer often experience physical side effects that influence the balance between their physiological, psychological, and social states.

Aim: The purpose of the study was to investigate what related factors affect the quality of sleep in patients with esophageal cancer.

Methods: This was a cross-sectional study design. This approach involved using the Chinese Pittsburgh Sleep Quality Inventory (CPSQI), the background information of patients with esophageal cancer and their associated medicine-related variance data. From March 2, 2015 to April 30, 2015, a deliberate sampling was collected at a medical center in Kaohsiung, Taiwan, where patients with esophageal cancer were targeted and recruited from an oncology ward, oncology clinics, a joint clinic of cardiothoracic and vascular surgery and esophageal cancer.

Results: A total of 100 patients with esophageal cancer participated. Statistical analyses were carried out using SPSS 18.0. The results showed an average score of 8.03 on the CPSQI, with 65 participants (65.0%) reporting poor quality of sleep. The quality of sleep was also found to be correlated with daily tobacco consumption, the ability to look after one self, and being underweight. According to the multiple linear regression results, the amount of tobacco consumed, self-awareness level, ability to look after oneself, Body Mass Index (BMI), and total score on the Chinese version of the Epworth Sleepiness Scale (CESS) were the most important predictors of the CPSQI quality of sleep.

Conclusion: Patients with esophageal cancer encounter quality of sleep problems of varying severity as the disease progresses. Clinical care workers should actively absorb professional knowledge, focus on patients' health conditions, and provide patients with complete nursing care education and procedures. By doing so, problems relating to quality of sleep in patients with esophageal cancer can be solved, and the overall quality of nursing care can be improved.

Keywords: Cancer patients; Esophageal cancer; Quality of sleep; CPSQI

Abbreviations

CPSQI: Chinese Pittsburgh Sleep Quality Inventory; CESS: Chinese version of the Epworth Sleepiness Scale; BMI: Body Mass Index

Introduction

According to research, in Taiwan esophageal cancer was ranked 10th in death rates, but the ranking rose to the 9th in 2013; moreover, esophageal cancer was ranked in the top five of the male's deadly cancer [1]. Which Middle-aged males are more likely to be affected by esophageal cancer, and most esophageal cancer patients smoked, drank alcohol, or chewed betel nuts in their youth. Because there are no significant symptoms in the early stages of esophageal cancer, most patients who are admitted to hospital to treat dysphagia or extreme pain have already been in stage 3 of cancer, including metastasis or terminal symptoms, and thus receive a diagnosis of esophageal squamous cell carcinoma with a poor prognosis [2,3]. The survival rate for esophageal cancer is less than 50% in the first year after diagnosis [4]. Moreover, esophageal cancer is one of the most malignant cancers in the gastrointestinal tract [4,5]. Over the past several years, a form of preoperative concurrent chemo radiotherapy (trimodality therapy) has been adopted gradually in clinical practice [3,4]. However, after the therapy, patients often suffer from physical side effects influencing their physical, psychological, and social states. Cancer patients experience fears of disability, role loss, body disfigurement, reliance, loss of control, loss of autonomy, and loss of daily life (For example, eating habits, personal hygiene, using the toilet, showering, take on and off the clothes, the control of defecate and urine, walking on flat ground, walking up and down

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the stairs, getting on and off the bed and sit on and stand up from chair) [6]. In physical terms, esophageal cancer patients often suffer from dysphagia, malnutrition, pain and exhaustion, while in terms of social and psychological problems, these patients suffer from the psychological stress, hopelessness, and uncertainty caused by the cancer [4].

Insomnia is one of the most common sleep disorders affecting cancer patients. Approximately 50% of cancer patients have experienced insomnia, and roughly 48% of cancer patients state that they have suffered from insomnia in the six months before and the eighteen months after their cancer diagnosis [7]. Insomnia influences the patients' emotions, cognitive functions, social functions, and quality of life [8]. Furthermore, even though oncology experts have long noticed changes in patients' sleep patterns, sleep problems were rarely evaluated until some studies investigating sleep disorders among cancer patients were conducted in recent years [8-11].

However, in Taiwan, the past studies investigating sleep disorders have focused on breast cancer patients and lung cancer patients; there have been no studies focusing on sleep disorders among esophageal cancer patients. Thus, this study sought to investigate the factors influencing sleep quality among esophageal cancer patients and is intended to serve as a reference for providing better quality care to esophageal cancer patients in the future.

Methods

Study design

This study employed a cross-sectional study design. A purposive sampling method was adopted to collect the data from the hematology–oncology ward and clinic, the thoracic and cardiovascular surgery ward and clinic, the joint clinic for esophageal cancer, and the radiation oncology clinic of a medical center in Kaohsiung, a city in southern Taiwan. This study was approved by the Institutional Review Board of the hospital and the data was collected via structured questionnaires.

Inclusion criteria

1. Patients who were clinically diagnosed with esophageal cancer (ICD-10).

2. Patients who underwent surgery, chemotherapy, or radiotherapy after diagnosis with esophageal cancer.

3. Patients who were conscious and able to express their thoughts clearly.

4. Patients aged 20 years old or older.

5. Patients who were able to communicate in Chinese or Taiwanese.

Exclusion criteria

1. Patients who were not able to understand the purpose of this study.

2. Patients who were not able to fill out the questionnaire because of severe illness.

This study was conducted from March 2, 2015 to April 30, 2015. On account of time constraints on the hospital's activities, among 121 cases that were considered to meet the qualification of the experiment, 100 patients gave their consent and turned out to participate in the research. As a result, 100 valid questionnaires were collected. Three main reasons why some patients refused to participate in the research are physical un-comfortableness due to illness, uncomfortable feelings of being studied, and insufficient time to do questionnaires because patients rushed to the next treatment.

Data collection

This study employed structured questionnaires, and the study data and tools included the following: (1) basic patient information (e.g., age, gender, ethnicity, level of education, marital status, religion, occupation, retirement status, income, alcohol intake, betel nut chewing, private medical insurance, living situation, self-care ability, and care provided by family and friends), which was filled in or otherwise provided by the patients themselves. If patients were illiterate, the researcher would recite all the questions regarding basic information in Chinese and Taiwanese for them to reply. (2) A medical variance form, including information on the time of esophageal cancer diagnosis, source (clinic/ward), Body Mass Index (BMI) (Kg/m^2), past health status (medical history/cancer history), diagnosis information (type/stage), treatment status (medical treatment/ the number of treatments), and side effects (physical conditions caused by the cancer/ treatment side effects), was collected from the medical records by the researchers. (3) The Chinese Pittsburgh Sleep Quality Inventory (CPSQI), which consisted of nineteen questions covering seven dimensions, namely, subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, daytime dysfunction, and use of sleep medication. Each question was scored from 0-3, with a total score of 21 points. Higher scores indicated poorer sleep quality. In terms of total scores, the cut-point was set at the 5-point mark, where a total score ≤ 5 indicated good sleep quality and a total score > 5 indicated poor sleep quality. Tsai et al., (2005) stated that the CPSQI has a good internal consistency and reliability (Cronbach's α= 0.82 - 0.83), with retest reliabilities of 0.85 (for all participants) and 0.77 (for participants with primary insomnia) [12] at 14-20 days after an initial administration of the test. The CPSQI is a good research tool with stability and sensitivity. (4) The Chinese version of the Epworth Sleepiness Scale (CESS) is a Chinese translation of the Epworth Sleep Scale (ESS), which was translated by Chen et al., in 2002 to evaluate participants' daytime sleepiness. The CESS consists of eight self-evaluated situations, including sitting and reading, watching television, sitting inactively in a public place (e.g., a cinema or a meeting), being in a car for an hour as a passenger (without a break), lying down to rest in the afternoon, sitting and chatting with someone, sitting quietly after lunch (not having had alcohol), and sitting in a stopped car in traffic for a few minutes. Scoring used a Likert scale (0-3 points) for total scores of between 0

Table 1: Statistical results for the CPSQI (N=100).

Variable	The number of participants	Percentage
Sleep quality		
Poor	65	65
Good	35	35

Note: 1. Each question was scored from 0-3, with a total score of 21 points. Higher scores indicated poorer sleep quality.
2. In terms of total scores, the cut-point was set at the 5-point mark, where a total score ≦5 indicated good sleep quality and a total score > 5 indicated poor sleep quality.

Table 2: The correlation analysis between patients' demographic data and sleep quality (*N*=100).

Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value	Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value
	No.	Percentage	No.	Percentage				No.	Percentage	No.	Percentage		
Age					1.004	0.316	Religion					0.324	0.569
≦55 years old	23	39.0	36	61.0			No	3	27.3	8	72.7		
>55 years old	12	29.3	29	70.7			Yes	32	36.0	57	64.0		
Ethnicity					0.524	0.770	Occupation					0.183	0.669
Taiwanese	31	34.8	58	65.2			No	1	25.0	3	75.0		
Mainland Chinese	2	28.6	5	71.4			Yes	34	35.4	62	64.6		
Hakka	2	50.0	2	50.0			Retirement					1.298	0.255
Education					0.690	0.708	Not retired	24	39.3	37	60.7		
≦ Primary school	7	29.2	17	70.8			Retired	11	28.2	28	71.8		
Middle school	12	40.0	18	60.0			Monthly income					1.983	0.576
≧High school or vocational school	16	34.8	30	65.2			None	23	34.3	44	65.7		
Marital status					3.525	0.172	≦ 20,000 NTD	0	0.0	3	100.0		
Single	3	33.3	6	66.7			20,000 ~ 40,000 NTD	7	38.9	11	61.1		
Marriage / Cohabitation	24	31.2	53	68.8			> 40,000 NTD	5	41.7	7	58.3		
Divorced/ Separated / Widowed	8	57.1	6	42.9									

Chi-squared tests were adopted. Significant difference α=0.05.

Table 2: The correlation analysis between patients' demographic data and sleep quality (*N*=100). (Cont.)

Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value	Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value
	No.	Percentage	No.	Percentage				No.	Percentage	No.	Times		
Exercise habit					1.147	0.284	Time of quitting cigarettes / month [c]					0.721	0.396
No	16	30.2	37	69.8			≦3 years[c-1]	26	32.9	53	67.1		
Yes	19	40.4	28	59.6			> 3 years	9	42.9	12	57.1		
Smoke					0.137	0.712	Drink					0.137	0.712
No	2	28.6	5	71.4			No	2	28.6	5	71.4		
Yes	33	35.5	60	64.5			Yes	33	35.5	60	64.5		
Numbers of cigrattes/day					6.116*	0.013	Alcohol intake/ day					0.027	0.870
≦40[a]	29	82.9	63	96.9			≦3 bottles [d]	29	35.4	53	64.6		
> 40	6	17.1	2	3.1			> 3 bottles	6	33.3	12	66.7		
Smoking history/ year					0.053	0.817	Drinking history/ year					0.617	0.432
≦30 years[b]	18	34.0	35	66.0			≦30 years[e]	25	32.9	51	67.1		
> 30 years	17	36.2	30	63.8			> 30年	10	41.7	14	58.3		

Chi-squared tests were adopted. Significant difference α=0.05, $^*p < 0.05$.

Note: [a,b] includes 7 non-smokers; [c] includes 93 smokers (where 60 participants have quit smoking, and 33 participants still smoke), [c-1] includes 7 non-smokers; [d,e] includes 7 non-drinking participants.

and 24. The higher the score, the higher the possibility of sleepiness was. A total score ≧ 10 indicated a daytime sleepiness problem [13]. Full consent to use CPSQI and CESS was granted.

Statistical analysis

SPSS 18.0 was adopted for statistical analysis. Descriptive statistics included the following: number, percentages. Inferential statistics included the following: the Chi-squared test was used for the difference between the variables and sleep quality; while linear multiple regression analysis was used to investigate the factors influencing the sleep quality of esophageal cancer patients.

Results

One hundred patients participated. The average age of the participants was 54.72 ± 8.75 years. Most of them were between 50 and 60 years old (45 participants, 45.0%), and the participants over

Table 2: The correlation analysis between patients' demographic data and sleep quality (*N*=100). (Cont.)

Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value	Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value
	No.	Percentage	No.	Percentage				No.	Percentage	No.	Percentage		
The time of quitting drinking / month[f]					2.366	0.124	Betel nut chewing history[i]					0.418	0.518
≦2 year[f-1]	20	29.9	47	70.1			≦3 years[i-1]	22	32.8	45	67.2		
> 2 year	15	45.5	18	54.5			> 3 years	13	39.4	20	60.6		
Eating betel nuts					3.046	0.081	Private medical insurance					1.648	0.199
No	7	22.6	24	77.4			None	11	27.5	29	72.5		
Yes	28	40.6	41	59.4			Yes	24	40.0	36	60.0		
Numbers of betel nuts intake/day					1.907	0.385	Living situation					1.622	0.203
1-50[g]	21	33.9	41	66.1			Live alone	4	57.1	3	42.9		
50 -100	9	31.0	20	69.0			Live with others	31	33.3	62	66.7		
>100	5	15.6	4	44.4			Main caregiver					<0.001	1.000
Betel nut chewing history					2.169	0.338	Self	7	35.0	13	65.0		
≦10 year[h]	11	26.8	30	73.2			Others	28	35.0	52	65.0		
10 -3years	10	43.5	13	56.5									
≥30 years	14	38.9	22	61.1									

Chi-squared tests were adopted. Significant difference α=0.05

Note: [f] indicates 93 participants who drink (where 86 participants have quit drinking, 7 participants still drink), [f,1]includes 7 participants who do not drink; [g-h] includes 31 participants who do not chew betel nuts; [i] indicates 69 participants who chew betel nuts (where 65 participants have quit betel nuts; 4 participants still chew betel nuts). [i,1] includes 31 participants who do not chew betel nuts.

Table 2: The correlation analysis between patients' demographic data and sleep quality (*N*=100). (Cont.)

Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value
	No.	Percentage	No.	Percentage		
Self-care ability and need					21.16***	< 0.001
Feeling well and no need for others' assistance, can take care of himself	30	54.5	25	45.5		
Feeling some physical discomfort; however, still can take care of himself	2	10.0	18	90.0		
Feeling physical discomfort and needing some assistance from others	3	16.7	15	83.3		
Feeling physical discomfort and needing total assistance from others	0	0.0	7	100.0		

Chi-squared tests were adopted. Significant difference α=0.05, ***$p < 0.001$

the age of 60 constituted the smallest proportion (26.0%). All the participants were male and had esophageal cancer. (Table 1) shows that there were 65 participants with poor sleep quality. In terms of the differences between demographic data and sleep quality, the results showed that the patients who smoked ≤ 40 cigarettes a day had poorer sleep quality than those who smoked > 40 cigarettes a day (96.9% *vs.* 3.1%), with a statistically significant difference (p=0.013); the patients who felt physical discomfort and needed total assistance from others had the poorest sleepy quality (100.0% *vs.* 90.0% *vs.* 83.3% *vs.* 45.5%; p < 0.001); other variables showed no significant difference with sleep quality (Table 2). (Table 3) shows the relationship between medical variables and sleep quality. The patients who were underweight (BMI<18.5kg/m^2) had the poorest sleep quality (84.0% *vs.* 69.8% *vs.* 45.8% *vs.* 37.5%), with a statistically significant difference (p =0.012); other variables showed no significant difference with sleep quality. In terms of the investigation of the predictive factors that influence sleep quality of patients with esophageal cancer, CPSQI is dependent variables. The relation of dependent variables, univariant analysis, basic patient information, and medical variables was taken into consideration. Based on Chi-square tests and Pearson's product-moment correlation coefficient, the results showed statistically significant level (p<0.200) that was adopted as independent variables in linear regression model. (Table 4) shows that a Variance Inflantion Factor (VIF) is 1.013-1.094 (<10), and tolerance is 0.914-0.987 (>0.1). As a result, Independent variable shows no collinear problem.

(Table 4) shows the factors which influenced the sleep quality of esophageal cancer patients according to the multiple linear regression analysis. The results showed that the overall variables could explain a total variance of 30.5% for PSQ (F=10.421, p<0.001), indicating that the model had significant influence and predictive ability on the independent variables (PSQ). For instance, the sleep quality score of "smoked >40 cigarettes a day" was 3.540 lower than that of "smoked ≤ 40 cigarettes a day" (t = - 2.485; p = 0.015); in terms of self-care ability, the sleep quality score of "feeling physical discomfort and needing total assistance from others" was 3.209 higher than that of "feeling well, can take care of himself" (t = 2.048; p = 0.043); with a BMI one point higher, the sleep quality score was 0.314 lower (t = - 3.075; p =

Table 3: The correlation analysis between the patients' medical variance and sleep quality (*N*=100).

Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value	Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value
	No.	Percentage	No.	Percentage				No.	Percentage	No.	Percentage		
Esophageal cancer history					0.503	0.478	Other cancer history					0.718	0.397
≦1year	23	37.7	38	62.3			None	28	37.3	47	62.7		
> 1 year	12	30.8	27	69.2			Yes	7	28.0	18	72.0		
Sources					2.942	0.086	Type of esophageal cancer cells					0.412	0.521
Clinic	26	41.3	37	58.7			SCC	33	34.4	63	65.6		
Ward	9	24.3	28	75.7			Adeno.	2	50.0	2	50.0		
BMI(kg/m^2)					10.931*	0.012	Position of esophageal cancer					0.341	0.843
Underweight BMI < 18.5	4	16.0	21	84.0			Upper	12	34.3	23	65.7		
Normal 18.5 ≦ BMI <24	13	30.2	30	69.8			Middle	12	32.4	25	67.6		
Slightly overweight 24 ≦ BMI <27	13	54.2	11	45.8			Lower	11	39.3	17	60.		
Slight obesity 27 ≦ BMI <30	5	62.5	3	37.5									
Other illness					2.224	0.136							
None	20	42.6	27	57.4									
Yes	12	28.3	38	71.7									

Chi-squared tests were adopted. Significant difference α=0.05, $^*p < 0.05$

Table 3: The correlation analysis between the patients' medical variance and sleep quality (*N*=100). (Cont.)

Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value	Variable	Good sleep quality		Poor sleep quality		χ^2	*p* value
	No.	Percentage	No.	Percentage				No.	Percentage	No.	Percentage		
Stage of esophageal\ cancer					0.220	0.974	Physical discomfort before treatments					1.537	0.215
Stage IA, IB	3	30.0	7	70.0			None	2	18.2	9	81.8		
Stage IIA, IIB	3	33.3	6	66.7			Yes	23	37.1	56	62.9		
Stage IIIA, IIIB, IIIC	22	36.7	38	63.3			Physical discomfort after treatments					1.056	0.304
Stage IV	7	33.3	14	66.7			None	7	46.7	8	53.3		
Treatments[a]					3.829	0.281	Yes	28	32.9	57	67.1		
Surgery	0	0.0	2	100.0									
chemotherapy and radiotherapy	30	39.0	47	61.0									
Chemotherapyand radiotherapy after surgery	3	37.5	5	62.5									
Others	2	15.4	11	84.6									

Chi-squared tests were adopted. Significant difference α=0.05, $^*p < 0.05$

Note: [a] In terms of treatments, "Others" indicates any treatments other than the three listed above. For instance, chemotherapy and radiotherapy before surgery, chemotherapy and radiotherapy before and after surgery.

0.003); with an ESS score one point higher, the PSQI score was 0.353 higher (t = 3.327; p = 0.002).

Discussion

Many different causes lead to insomnia among cancer patients, including physical influences, psychological influences, cancer-related depression, pains caused by the cancer, and side effects from the treatments and all of these factors may combine to influence sleep disorders among cancer patients [8].

After conducting the linear regression analysis, this study found that the PSQI scores were influenced by smoking, self-care ability, BMI, and the total scores of ESS, with a total variance of 30.5% which can explain the overall variables. The sleep quality score of "smoke

Table 4: Factors influencing esophageal cancer patients' PSQI results (*N*=100).

Variable		Unstandardized coefficient		Standardized coefficient	t	*p* value	collinearity statistics	
		Estimation of β	Standard error	β distributions			tolerance	VIF
(constant)		17.173	2.871		5.981	0.000		
number of cigarettes per day	≦40	(Reference group)						
	>40	-3.687	1.431	-0.222	-2.576*	0.012	0.987	1.013
Self-care ability	Feeling well, can take care of himself"	(Reference group)						
	Feeling physical discomfort and needing total assistance from others	3.209	1.567	0.182	2.048*	0.043	0.931	1.074
BMI		-0.314	0.102	-0.275	-3.075**	0.003	0.914	1.094
A total of ESS scores		0.353	0.109	0.282	3.237**	0.002	0.966	1.035

A multiple linear regression analysis was adopted. Significant difference α=0.05

*p<0.05, **p<0.01.

Note: R^2=30.5%

> 40 cigarettes a day" was 3.540 lower than that of "smoked ≤ 40 cigarettes a day" (t = - 2.485; p = 0.015), indicating that the patients who smoked > 40 cigarettes a day had better sleep quality than those who smoked ≤ 40 cigarettes a day. This result was inconsistent with the other research. The Taiwan Society of Sleep Medicine (2012) has stated that tobacco contains nicotine, which interferes with sleep quality. A few seconds after smoking, nicotine will be sent to the brain through blood, stimulating the release of various neurochemicals. These neurochemicals stimulate the central nervous system and sympathetic nervous system, causing higher alertness, higher blood pressure, and higher heart rates, thereby influencing sleep quality. Thus, nicotine is detrimental to sleep quality [14]. Related studies have indicated that quitting smoking can improve sleep quality [15] and that smokers have a higher rate of sleep problems; double that of normal people, where difficulty falling asleep is the most common problem [16]. According to the Tobacco Hazards Prevention Website of the Health Promotion Administration of Taiwan's Ministry of Health and Welfare (2013), smoking influences health and sleep quality, and the latest study shows that every cigarette leads to a 1.2 minute decrease in a smoker's sleep time [17]. For the differences between this study and past studies, a possible cause may be that the average smoking history of the participants in this study was 27.3 cigarettes a day for 29 years. Most of the participants were also in stage III of esophageal cancer (60%), and they relieved their physical and psychological stress through smoking.

One of the results in this study showed that the patients who felt physical discomfort and needed total assistance from others had poorer sleep quality than those who felt well and could take care of themselves. This result was consistent with a past study indicating that breast cancer patients experience a change in their sleep status (which is the second most common physical problem) and that those who endorsed the statement "I can do something to prevent insomnia" presented the worst in terms of self-care ability [18]. The patients with higher BMIs had greater sleep quality. This result is consistent with that of a study by Asplund et al., (1995). Asplund et al., (1995) indicated that women aged 60-64 with a BMI < 20kg/m^2 were awoken more frequently at night (twice as often as those with a BMI ≥30 kg/m^2) and that women aged 60 with a BMI < 20 kg/m^2 were forty times more likely to wake up at night than those aged 40 [19]. Higher ESS scores indicated poorer sleep quality, which is consistent with what Davidson et al., (2002) reported. Davidson et al., (2002) investigated sleep disorders among cancer patients and found that the common problems relating to sleep disorders were "over exhaustion (44%)", "anxiety (31%)", and "sleepiness (28%)" [10], indicating that cancer patients experience sleep disorders, insomnia, and sleepiness at the same time.

There were several limitations to this study. Firstly, due to human factors and the study time, this study employed a cross-sectional method, collecting and investigating based on the patients' current status; thus, it was difficult to investigate the changes to and differences in sleep quality at different time points. Secondly, our study did not collect sufficient information on the usage of prescribed medicine to treat sleeping disorder and might affect the factors of sleep quality from the participants. It is possible that residual confounding by these factors may also affect the esophageal cancer- sleep quality link.

Furthermore, the participant data was collected from the hematology–oncology ward and clinic, thoracic and cardiovascular surgery ward and clinic, joint clinic for esophageal cancer, and radiation oncology clinic of a single medical center in southern Taiwan (not from various hospitals). Because of the small subject size, about 100 valid subjects, the subjects were, perhaps, not representative of the total population of patients with esophageal cancer. Future studies can conduct longitudinal study to investigate esophageal cancer patients' sleep problems at different time points and can adopt blood tests and objective evaluation tools (such as 24-hour monitoring actigraphy or polysomnography) to evaluate sleep quality, to identify the influencing factors, and to further illuminate this research topic.

Conclusion

The PSQI results indicated that 65 of the esophageal cancer participants (65.0%) had poor sleep quality. The factors influencing the PSQI results were (1) the number of cigarettes smoked per day (the patients who smoked > 40 had better sleep quality than those who smoked ≤ 40); (2) self-care ability (the patients who felt physical discomfort and needed total assistance from others had poorer sleep quality); (3) BMI (the patients with higher BMI values had better sleep quality); and (4) ESS score (patients with a higher total score on the ESS had poorer sleep quality).

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