Lung Cancer–Related Dyspnea

The effects of a handheld fan on management of symptoms

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BACKGROUND: The application of a handheld fan may reduce patients' shortness of breath and increase their activity tolerance by enabling cooling and air flow into the second and third branches of the trigeminal nerve.

OBJECTIVES: The aim of the study was to assess the effects of directing a handheld fan toward the face in the management of lung cancer–related dyspnea.

METHODS: Using a randomized controlled experimental design, 96 inpatients with lung cancer were evaluated, with the experimental group (n = 49) using a handheld fan to manage dyspnea for 14 days. Dyspnea, respiration rate, oxygen saturation, heart rate, and quality of life were assessed for both groups.

FINDINGS: A statistically significant difference was found in dyspnea scores between groups on the first, seventh, and fourteenth days of fan application, and statistically significant differences were found between groups in dyspnea scores, respiration rates, oxygen saturation, heart rate, and quality of life on the fourteenth day of application.

KEYWORDS
lung cancer; palliative care; fan therapy; dyspnea; quality of life

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DYSPNEA IS A SYMPTOM THAT IS FREQUENTLY EXPERIENCED by patients with lung cancer, which can negatively affect well-being and prevent patients from performing activities of daily living, including personal care needs (Mendoza et al., 2020). The prevalence of dyspnea is higher (57%–90%) in patients receiving palliative care (Rogers et al., 2020). Although dyspnea can reduce the quality of life of patients receiving palliative care, early introduction of palliative care to patients with lung cancer is associated with improved quality of life and survival (Cope et al., 2018).

One nonpharmacologic approach that is used in dyspnea management is applying air to the face using a handheld fan. The application of a handheld fan may reduce patients' shortness of breath and increase their activity tolerance by enabling cooling and air flow into the second and third branches of the trigeminal nerve (Morélot-Panzini, 2017). It is believed that this result is achieved through the cooling of the nasal or airway mucosa or through the fanning of the facial skin. Another mechanism behind the effectiveness of the handheld fan is that it provides distraction and relaxation to reduce patients' dyspnea; as patients pay attention to the handheld fan, their perception of their dyspnea decreases (Luckett et al., 2017). A different perspective suggests that the handheld fan alters the brain's perception of signals coming from respiratory afferent nerves, supporting psychological and emotional management. This is also described as "fooling the brain" "to make it believe" that the respiratory system functions better than it actually does (Morélot-Panzini, 2017, p. 1).

The literature contains examinations of the short-term effects of handheld fans on dyspnea management in patients with lung cancer (Puspawati et al., 2017; Wong et al., 2017); however, the long-term effects of regular handheld fan application have not been determined. In a study by Booth et al. (2016), which was carried out with a mixed group of patients, fan application had a moderate clinical effect on patients with resting dyspnea, but this effect was not statistically significant. In Booth et al.'s (2016) study, the rate of patients whose dyspnea scores improved after fan application was 55% on a visual analog scale and 61% on a numeric rating scale. Another study by Swan et al. (2019) revealed that the use of a handheld fan supported a faster recovery in treating effort-related dyspnea. As an adjunct to standard of care, handheld fans were also effective in alleviating dyspnea among adult

patients with stage III or terminal cancer at the end-of-life phase (Mendoza et al., 2020).

Previous studies have evaluated the effects of a handheld fan directed toward the face on respiration rate, heart rate, blood pressure, dyspnea score, and oxygen saturation (SpO_2), but its effects on pulmonary function test (PFT) values and arterial blood gas (ABG) levels have not been investigated. In addition, none of these studies has discussed the effects of a handheld fan on quality of life. The aim of this study was to examine how long-term use of a handheld fan directed at the face affects the dyspnea management of patients with lung cancer receiving palliative care.

Methods

The study used a randomized controlled experimental design. Ethical approval to conduct this study (decree number: 2017/11/11) was received from the Ethics Committee of the Acibadem University in Istanbul, Turkey. Verbal and written consent were obtained from the participants included in the sample.

Sample and Setting

The study sample consisted of 142 patients who were hospitalized on the palliative care unit because of a lung cancer diagnosis between January 2018 and January 2019 at the Istanbul Sureyyapasa Chest Diseases and Thoracic Surgery Training and Research Hospital in Turkey. Forty-six patients were excluded based on the inclusion criteria. The 96 participants who were included in the study were divided into an experimental group (using a handheld fan [n = 47]) and a control group (receiving standard care only [n = 49]) by a researcher-prepared randomization checklist that was created in Microsoft® Excel®.

The inclusion criteria for participation were as follows: having stage III or IV lung cancer; being aged 18 years or older; voluntarily participating in the study; and having a hemoglobin (Hgb) value of 8 mg/dl or higher, an SpO_2 of 90% or higher, a modified Borg scale (MBS) score of more than 3, and an Eastern Cooperative Oncology Group (ECOG) Scale of Performance Status score of 3 or lower. The exclusion criteria for participation were as follows: having a temperature of 38ºC or higher within the past 24 hours, having a cognitive or affective disorder or any issue hindering verbal communication, having a psychiatric disorder, suffering from an infectious disease, having undergone thoracentesis because of pleural effusion prior to the study, and having a muscular disease.

After patients agreed to participate and the study started, participants were excluded from the study sample if they wanted to leave the study, died, were intubated, were taken to the intensive care unit, or underwent thoracentesis because of pleural effusion. During the study, 19 patients who stated that they did not want to continue, 7 patients who died, 4 patients who lost consciousness, and 1 patient who underwent thoracentesis were all excluded from the study sample.

"The application of a handheld fan may reduce patients' shortness of breath and increase their activity tolerance."

Procedures

The standard-of-care approach of the hospital (oxygen therapy, bronchodilator drugs, semi-Fowler positioning) was given to participants in both the experimental and control groups. Participants in the experimental group were also trained by a researcher on how to use the handheld fan. Following the training, participants in the experimental group were asked to use the handheld fan—held 15 cm away from the face—for five minutes three times per day (before breakfast, lunch, and dinner) for 14 days. Three-propeller, battery-operated, handheld fans with a flow velocity of 4 km/hour were procured for use in the study (Puspawati et al., 2017).

Participants in both groups were followed for 14 days, and data were collected daily. On the first day of the study, data were collected using a patient diagnosis form, the MBS, vital signs, the Functional Assessment of Chronic Illness Therapy–Palliative Care (FACIT-Pal), and the ECOG Scale of Performance Status. Participants' PFT values and ABG levels were also assessed on the first day. From the second day on, no intervention was applied to the control group, and the MBS and vital signs were completed every day. In the experimental group, the MBS and vital signs were completed every day before and after use of the handheld fan (before dinner). The quality of life of both groups was assessed using the FACIT-Pal on the first, seventh, and fourteenth days. Participants' PFT values and ABG levels were also reassessed on the fourteenth day.

Data Collection

Data were collected using a patient diagnosis form, the ECOG Scale of Performance Status, vital signs, the MBS, and the FACIT-Pal. Regarding data related to dyspnea, ABG levels and PFT values were assessed at the beginning and end of the study. Data were also obtained concerning sociodemographic characteristics, as well as disease-related and palliative processes, using the patient diagnosis form and the ECOG Scale of Performance Status. The short-term effects of handheld fan use were determined

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by comparing MBS scores and vital signs of participants in the experimental group before and after using the fan. To evaluate the long-term effects of using the handheld fan, MBS scores, vital signs, FACIT-Pal scores, PFT values, and ABG levels were compared from the first and the fourteenth days.

PATIENT DIAGNOSIS FORM: This researcher-prepared form included 41 questions about participants' sociodemographic information, as well as characteristics related to the disease, palliative care, and dyspnea.

THE EASTERN COOPERATIVE ONCOLOGY GROUP SCALE OF PERFORMANCE STATUS: The ECOG Scale of Performance Status assessed the dependence and well-being of participants in performing self-care. Participants' dependence was rated on a five-point Likert-type scale ranging from 0 to 4 (0 = fully active, with no performance restrictions; 1 = fully ambulatory and able to complete light work, with strenuous physical activity restricted; 2 = unable to carry out work-related activities but capable of performing all self-care, with more than 50% of waking hours spent being up and about; 3 = limited to a chair or bed for more than 50% of waking hours and capable of only limited self-care; 4 = completely disabled, confined to a chair or bed, and unable to carry out self-care) (Oken et al., 1982).

MODIFIED BORG SCALE: The MBS was originally developed in 1970 for the purpose of measuring the effort given during physical exercise. The scale was revised in 1982 into a scale of 12 items identifying degrees of dyspnea severity, with scores ranging from 0 (not present) to 10 (maximum severity) and higher scores indicating higher dyspnea severity (Johnson et al., 2016).

FUNCTIONAL ASSESSMENT OF CHRONIC ILLNESS THERAPY–PALLIATIVE CARE: The FACIT-Pal, which was used to assess quality of life in patients receiving palliative care, includes a total of 46 items and 5 subscales, with higher overall scores indicating a higher quality of life. Items are evaluated by the patient using a five-point Likert-type scale. Negatively stated items are reversed by subtracting the response from 4. After reverse scoring the items, all subscale items are summed to a total, which is the subscale score (Lyons et al., 2009). This scale's validity and reliability for patients receiving palliative care have been determined (Lyons et al., 2009). An examination of the internal consistency of the overall FACIT-Pal scale revealed a Cronbach's alpha of 0.854 on the first day, 0.818 on the seventh day, and 0.853 on the fourteenth day.

Data Analysis

Data were analyzed using descriptive statistics (means, standard deviations, medians, frequencies, minimums, and maximums), t tests, analysis of variance, Bonferroni correction paired assessments, Mann–Whitney U tests, Kruskal–Wallis tests, Dunn–Bonferroni tests, Friedman tests, Wilcoxon signed rank tests, and Pearson's chi-squared tests or Spearman's correlation coefficients. Statistical significance was set at $p < 0.05$.

TABLE 1.
SAMPLE CHARACTERISTICS BY GROUP

	EXPERIMENTAL (N = 47)		CONTROL (N = 49)			
CHARACTERISTIC	$\bar{X}$	**SD**	$\bar{X}$	**SD**	**t**	**p**
Age (years)	65.77	9.1	64.27	8.22	0.848	0.398[a]
Disease duration (years)	1.95	2.07	1.61	2.09	−0.766	0.444[b]
CHARACTERISTIC		**n**		**n**	**t**	**p[c]**
Gender					0.047	0.828
Male		41		42		
Female		6		7		
Education level					1.812	0.404
Illiterate		10		9		
Primary school		29		26		
High school or more		8		14		
Marital status					0.952	0.329
Married		39		44		
Single		8		5		
Comorbidities					0.023	0.88
Yes		30		32		
No		17		17		
Diagnosis					0.692	0.405
NSCLC		34		39		
SCLC		13		10		
Disease stage					0.333	0.564
III		17		15		
IV		30		34		
Smoking status					0.552	0.759
Former smoker		34		37		
Current smoker		7		8		
Never smoker		6		4		

[a] Student t test
[b] Mann–Whitney U test
[c] Pearson's chi-squared
NSCLC—non-small cell lung cancer; SCLC—small cell lung cancer

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TABLE 2.
EFFECTS OF APPLYING A HANDHELD FAN TO THE FACE ON MBS SCORES BY GROUP

	EXPERIMENTAL							CONTROL				
DAY	N	PRE $\bar{X}$	SD	POST $\bar{X}$	SD	DIFF $\bar{X}$	DIFF SD	N	$\bar{X}$	SD	Z	p[a]
1	47	6	1.16	4.63	1.12	−1.37	0.88	49	5.33	1.14	−2.604	0.009
7	35	5.63	1.19	3.91	1.26	−1.74	0.93	33	5.64	1.19	−4.793	0.001
14	32	4.67	1.05	3.06	0.95	−1.56	0.8	33	5.53	0.98	−6.356	0.001

[a] Mann–Whitney U test scores when comparing the control group scores to post scores in the experimental group
diff—difference; MBS—modified Borg scale; pre—preapplication; post—postapplication
Note. The overall p value on the Mann–Whitney U test was 0.216 for the control group and 0.001 when comparing control group scores to the post scores of the experimental group. On the Friedman test, p = 0.001 for all days.
Note. The MBS was used to measure the degree of dyspnea severity. Scores range from 0 to 10, with higher scores indicating greater dyspnea severity.

The FACIT-Pal post hoc effect size of the experimental and control groups on the fourteenth day was found to be 1.068, and the sample power was 98.8%. Following application of the handheld fan, the post hoc effect size of the MBS scores of the experimental group was found to be 2.566 as compared to the control group; accordingly, the effect power was found to be 100%.

Results

The average age of participants in the sample group (N = 96) was 65 years (SD = 8.65) (see Table 1). The experimental and control groups did not significantly differ regarding having undergone a previous surgery (χ = 2.202, p = 0.138), undergoing radiation therapy (χ = 0.127; p = 0.721), or undergoing chemotherapy (χ = 0.012, p = 0.911). Participants' average length of stay on the palliative care unit was 9.59 (SD = 9.49) days, and the ECOG score for the majority of participants was 3. Participants' average Hgb value was 12.24 (SD = 2.21), and their average hematocrit value was 36.66 (SD = 6.42). Sociodemographic and clinical characteristics were similar across the experimental and control groups (p > 0.05).

The MBS scores of the experimental group on the first, seventh, and fourteenth days of handheld fan use were statistically lower than those of the control group (p < 0.01), which was significant. In addition, the MBS scores of the experimental group on the first, seventh, and fourteenth days of handheld fan use were significantly lower than their values before the fan was used (p = 0.001) (see Table 2).

There were no statistically significant differences between the PFT values and ABG levels of participants in both groups on the fourteenth day of the study (p > 0.05). In within-group comparisons of PFT values and ABG levels of the experimental and control groups on the first and fourteenth days, the use of a handheld fan had no effect at all (p > 0.05). Table 3 shows the SpO_2 measurements, respiration rates, heart rates, and blood pressures of the participants in the experimental and control groups.

No statistically significant difference was found between the experimental and control groups in total FACIT-Pal scores on the first day (p > 0.05), whereas the total scores of the experimental group were higher on the seventh and fourteenth days as compared to the control group (p < 0.05), which was significant (see Table 4).

Discussion

Dyspnea has a negative effect on patients, both emotionally and physically, and it may also negatively affect activities of daily living unless it is managed effectively (Ekström et al., 2016; Patel, 2018). In this study, the MBS scores of the participants in the experimental group were lower on the fourteenth day as compared to the other days, indicating that long-term use of the handheld fan was effective in reducing participants' dyspnea.

In the literature, it has been revealed that handheld fan use is effective in decreasing dyspnea symptoms among patients with cancer (Kako, Morita, Yamaguchi, Kobayashi, et al., 2018; Puspawati et al., 2017). Previous studies have revealed that handheld fan application also reduces respiration rate (Kako, Morita, Yamaguchi, Sekimoto, et al., 2018; Puspawati et al., 2017) and significantly enhances parameters such as dyspnea and SpO_2 (Kako, Morita, Yamaguchi, Kobayashi, et al., 2018). The current study supports these results by showing that use of the handheld fan reduced respiration rates and increased SpO_2. However, one study showed that handheld fan use did not reduce respiratory rate and SpO_2 values (Wong et al., 2017). Patients may state that they feel well after using a handheld fan; however, unless the application is performed properly and adequately, it may not affect the physiopathologic process of dyspnea.

Heart rates in the experimental group were lower on the fourteenth day of handheld fan application as compared to the control group. This can be explained by the fact that using the handheld fan on the face reduces heart rate and causes changes in dyspnea perception through the stimulation of the trigeminal

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nerve, as well as through the diving reflex. The diving reflex is an adaptation that involves reducing heart rate to reduce the body's need for oxygen when the face comes into contact with cold (Lemaitre et al., 2015).

In this study, no difference was found between the experimental and control groups in terms of PFT values and ABG levels. It was believed that as dyspnea decreased, participants' anxiety would decrease and their vital signs would improve, but this was not correlated with PFT improvement. ABG analysis is often performed to assess acid-based disturbances and to diagnose and quantify respiratory insufficiency in dyspnea. During follow-up assessment, ABG levels may not have changed because participants remained in a stable condition, with no additional disease.

Patients with lung cancer experience numerous adverse effects related to the disease or its treatment, including dyspnea,

TABLE 3.
EFFECTS OF APPLYING A HANDHELD FAN TO THE FACE ON VITAL SIGNS BY GROUP

	EXPERIMENTAL								CONTROL				
DAY	N	PRE $\bar{X}$	PRE SD	POST $\bar{X}$	POST SD	$\bar{X}$ DIFF	$\bar{X}$ SD	p	N	$\bar{X}$	SD	t	p
Respiration rate (breaths per minute)													
1	47	25.74	5.53	24.04	4.7	−2	2.39	0.001[a]	49	24.82	5.03	−0.773	0.442[b]
7	35	25.77	4.78	24	4.89	−1.94	1.91	0.001[a]	33	23.73	5.01	0.225	0.822[b]
14	32	23.76	3.49	21.81	3.38	−2.13	1.72	0.001[a]	33	23.75	4.56	−1.931	0.058[b]
Oxygen saturation (%)													
1	47	95.6	2.91	96.63	2.64	1.04	1.92	0.001[c]	49	95.82	2.79	−1.991	0.047[d]
7	35	96.49	1.95	97.56	1.78	1.09	1.4	0.001[c]	33	95.52	3.24	−3.736	0.001[d]
14	32	96.12	1.71	97.25	4.02	1.09	3.98	0.001[c]	33	95.75	1.97	−3.819	0.001[d]
Heart rate (beats per minute)													
1	47	95.13	16.7	93.89	15.43	−2.11	3.99	0.001[a]	49	95.08	15.06	−0.380	0.705[b]
7	35	93.63	16.74	92.38	14.87	−2.18	4.86	0.014[a]	33	95.33	14.33	−0.827	0.411[b]
14	32	92.85	13.55	88.28	13.69	−5.25	4.09	0.001[a]	33	95.88	13.49	−2.235	0.029[b]
Systolic blood pressure													
1	47	125	20.23	120.24	16.79	−4.72	8.66	0.001[a]	49	120.98	15.35	−0.225	0.823[b]
7	35	120.74	15.46	116.41	15.57	−4	9.1	0.015[a]	33	121.03	16.33	−1.185	0.24[b]
14	32	117.79	13.28	113.72	12.75	−3.56	4.19	0.001[a]	33	120.16	10.81	−2.178	0.033[b]
Diastolic blood pressure													
1	47	71.34	11.52	69.33	9.66	−1.89	6.78	0.065[a]	49	69.92	10.52	−0.285	0.776[b]
7	35	69.37	8.93	65.97	7.07	−3.21	6.73	0.009[a]	33	67.27	6.7	−0.773	0.442[b]
14	32	68.82	7.05	66.41	7	−2.25	4.24	0.005[a]	33	66.66	5.25	−0.162	0.872[b]

[a] Paired sample t test
[b] Student t test
[c] Friedman test
[d] Mann–Whitney U test
diff—difference; pre—preapplication; post—postapplication
Note. Overall p values for respiration rate were 0.029 (pre), 0.002 (post), and 0.193 for control. Overall p values for oxygen saturation 0.521 (pre), 0.001 (post), and 0.604 for control. Overall p values for heart rate were 0.375 (pre), 0.004 (post), and 0.168 for control. Overall p values for systolic blood pressure were 0.148 (pre), 0.255 (post), and 0.804 for control. Total p values for diastolic blood pressure were 0.576 (pre), 0.262 (post), and 0.339 for control.

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IMPLICATIONS FOR PRACTICE

- Increase the quality of life of patients with lung cancer who are receiving palliative care by managing distressing symptoms, such as dyspnea.
- Apply a handheld fan to the face of patients who are experiencing lung cancer–related dyspnea for five minutes to manage symptoms.
- Educate patients on how airflow stimulation from a handheld fan can help to relieve dyspnea and encourage its use for self-management of symptoms.

cough, pain, and fatigue, all of which are a major detriment to quality of life (Rui-Chen et al., 2020). The current study found that the quality of life of the experimental group was better than that of the control group on the fourteenth day of the study, indicating that long-term use of the handheld fan influenced patients' overall quality of life. Therefore, the use of a handheld fan is a practical, inexpensive, and home-friendly approach to manage dyspnea in this patient population.

Limitations

This study had some limitations. The study was conducted at a single center, and a small number of patients were included in the sample. In addition, it was difficult to follow up with participants in the longer term because of higher mortality rates in lung cancer.

Implications for Nursing

Dyspnea is prevalent and often severe in patients with advanced lung cancer who are receiving palliative care. Battery-operated, handheld fans are preferred by patients because they are cheap and portable. This study has several implications for palliative nursing, including enhancing nursing knowledge about interventions for patients with lung cancer who experience dyspnea. Nurses can use the handheld fan on the faces of patients with lung cancer for dyspnea management; in particular, palliative care nurses can use fans on both sides of the nose and upper lip of patients with dyspnea for five minutes from a distance of 15 cm. Nurses can also educate patients on relieving dyspnea using airflow stimulation from a handheld fan and encourage its utilization (within the scope of patients' self-management) during dyspnea.

Conclusion

This study found that long-term use of the handheld fan was an effective approach in managing dyspnea related to lung cancer, enhancing patients' quality of life, and reducing dyspnea severity, respiration rate, and heart rate, as well as increasing SpO_2. However, the use of a handheld fan was not shown to be effective in improving pulmonary functions and blood gas levels. It is recommended that researchers study the application of the handheld fan in future studies with groups other than patients with lung cancer and with larger samples.

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TABLE 4.
EFFECTS OF APPLYING A HANDHELD FAN TO THE FACE ON QUALITY OF LIFE SCORES BY GROUP

	EXPERIMENTAL			CONTROL				
DAY	N	$\bar{X}$	SD	N	$\bar{X}$	SD	t	p[a]
1	47	112.4	14.74	49	113.59	21.51	−0.314	0.754
7	35	122.11	14.64	33	112.36	20.77	2.248	0.028
14	32	132.21	16.06	33	112.38	20.76	4.317	0.001

[a] Student t test
Note. Quality of life was measured using the Functional Assessment of Chronic Illness Therapy–Palliative Care. Total scores range from 0 to 184, with higher scores indicating better quality of life.
Note. The overall p value for the experimental group was 0.001 and 0.659 for the control group.

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