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How Does Health Education Given to Lung Cancer Patients Before Thoracotomy Affect Pain, Anxiety, and Respiratory Functions?

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Abstract
In this study, it was aimed to determine how the postoperative pain level, state-trait anxiety level, and respiratory function were affected by the health education given through a patient education booklet to patients with lung cancer, in comparison with control group, before pulmonary resection through thoracotomy. The 60 patients ($n = 60$) having pulmonary resection indication because of lung cancer were recruited in the present study. The patients were separated as control ($n = 30$) and experimental groups ($n = 30$). The patient education was applied to patients in the experimental groups via the education booklet 24 h before the surgery. Patients in the control groups received only usual clinical nursing information. The pain was evaluated via visual analog scale (VAS). The State-Trait Anxiety Scale (STAS) was used for evaluating the anxiety level. The evaluated pulmonary functions were peak expiratory flow (PEF), forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1), and forced expiratory flow 25–75 (FEF25–75). The pain level of the experimental group was statistically lower than control group ($p < 0.05$). The state anxiety level of experimental group received education was statistically lower than control group ($p < 0.05$). There was no any statistical difference in trait anxiety levels between control and experimental groups ($p > 0.05$). The FEV1 and FEF25–75 values in experimental group were statistically higher than control group. A planned health education applied via the thoracotomy patient education booklet has a positive effect on clinical recovery process by affecting postoperative pain, state anxiety, and FEV1 and FEF25–75 values.

Keywords Anxiety · Education · Pain · Patient · Thoracotomy

Introduction

Early treatment of lung cancer, which is the most common type of cancer in the world, is surgery. Pulmonary resection methods such as pneumonectomy, lobectomy, segmentectomy, and wedge resection are performed for surgical treatment [1, 2]. During pulmonary resections, thoracic wall is opened by surgical procedure called thoracotomy, and the lesioned area is intervened [3].

Patients after thoracotomy complain of severe pain due to the fact that anatomical structures on the chest wall are affected. Postoperative respiratory functions are adversely affected by pain. It has also been reported that severe pain prevents coughing effectively [4]. Patients before thoracotomy are hospitalized for many clinical tests. With admission to the hospital, ongoing life patterns of patients change, and there is an unusual anxiety situation in patients. Prior to surgery, patients' overall health status, future expectancy, and anesthesia process affect the anxiety level [5]. Patients' not having sufficient knowledge about the diagnosis of the disease, treatment procedure, and anesthesia methods are also factors that negatively affect anxiety level [6]. On the other hand, the level of anxiety is related to the severity of pain before, during, and after surgery. Patients' behavioral response to increased severity of anxiety may be higher than normal postoperatively. This affects postoperative pain adversely and makes pain management difficult [7].

Another complication seen in patients after thoracotomy is a decrease in lung capacities. It is known that in the acute period after pulmonary resection, the values of forced vital capacity (FVC) and forced expiratory volume in the first second (FEV1) decrease significantly. The decrease in lung capacity depends on pain severity, demographic characteristics of patients, disease history, anesthesia procedure, type of surgery, and development of additional complications [8, 9].

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Patient education is the basic approach for patients to learn about their health status and treatment processes. Different methods are used in the education given before the operation, during the hospitalization, after the operation or when discharged. In addition to verbal education, which is the basis of patient education, printed and multimedia-supported educational materials are also used [10]. A well-planned education provides active participation of the patient in the healing process. It decreases the level of anxiety and the length of stay in the hospital and increases the overall satisfaction level [11].

Patient education has positive effects on healing process and clinical status of patients after thoracotomy as well as in different surgical procedures [12]. It has been reported that the education given before pulmonary resection increases the interaction between the patient and the health worker, improves the physical and psychological well-being of the patient, and reduces the risk of complications [13]. However, there is a limited number of studies investigating how preoperative education given to patients who will undergo thoracotomy due to pulmonary resection affects anxiety, pain level, and respiratory function.

In this study, it was aimed to determine how the postoperative pain level, state-trait anxiety level, and respiratory function were affected by the health education given through a patient education booklet to patients with lung cancer, in comparison with control group, before pulmonary resection through thoracotomy.

Methods

Study Design and Participants

This study was carried out in the Gaziantep University Chest Surgery Unit of Application and Research Hospital. The data was collected between November 2016 and February 2017. Patients with pulmonary resection indications such as thoracotomy, pneumonectomy, lobectomy, segmentectomy, wedge resection, and atypical resection due to lung cancer were included in the study. Patients with a postoperative verbal communication problem, a previous psychiatric diagnosis, a psychiatric medication, a thoracic surgery history, a musculoskeletal system anomaly in the chest area, epidural analgesia after surgery, and metastatic tumor spread were excluded. The number of patients to be included in this study, which was a clinical trial research study, was determined by using the sample calculation formula that is used in cases where the number of individuals in the target population is known [14]. Based on this formula, a total of 60 patients between 18 and 85 years of age were included in the study. The patients were divided into two groups as control ($n = 30$) and intervention ($n = 30$).

The patients in the control group were assessed for pain levels, anxiety levels, and respiratory functions 24 h before surgery and 24 h after they were admitted to the service postoperatively. Only routine clinical practices were performed on the patients in the control group before and after surgery. The patients in the intervention group were assessed for pain levels, anxiety levels, and respiratory functions 24 h before surgery when they were admitted to the service. It is known that the education given using printed educational materials is a model that completes the education given verbally [13]. For this reason, the information in the "thoracotomy patient education booklet" was verbally explained by the researcher to each patient in the intervention group, in addition to the routine clinical application before the operation. The patient was asked to read all the information contained in the booklet. The total duration of the health education given to the patients varied between 20 and 30 min. The health education was carried out one-to-one in an empty and calm room in the service. The patients in the intervention group were reassessed for pain levels, anxiety levels, and respiratory functions 24 h after they were admitted to the service. All patients underwent the same anesthesia and analgesia protocols in order to ensure standardization between the patient groups receiving and not receiving the patient education.

Data Collection Instruments

Prior to thoracotomy, information was collected about the patients' socio-demographic characteristics, educational statuses, alcohol-cigarette uses, body mass indices (BMIs), planned operation types, surgical operation histories, family histories, and previous treatment histories. Postoperatively, the patients' durations of intensive care, extubation and service stay, and characteristics of their surgical interventions were recorded.

Before and after thoracotomy, information about the patients' pain type, duration, and localization was recorded. The patients' pain severity was assessed using the visual analog scale (VAS), which is a valid method of measuring postoperative pain intensity before and after surgery, while resting, coughing, and mobilizing within the bed [15].

The patients' anxiety levels before and after thoracotomy were assessed using the Turkish translation of the State-Trait Anxiety Inventory (STAI) developed by Spielberg et al. [16]. The translation of the inventory to Turkish, and its validity and reliability were carried out by Öner and Le Compte [17]. The STAI consists of two separate inventories, "State Anxiety Inventory (SAI)" and "Trait Anxiety Inventory (TAI)," and contains a total of 40 items. The first 20 questions of the STAI measure the level of state anxiety, and the last 20 questions of it measure the level of trait anxiety [16, 17]. The scores obtained on each inventory range from 20 to 80. A large score refers to high level of anxiety, and a small score refers to low level of anxiety. In this study, the state and trait anxiety scores of patients before and after thoracotomy were calculated separately.

The patients' peak expiratory flow rate (PEF-%), forced vital capacity (FVC-%), forced expiratory volume in the first second (FEV1-%), and forced mid-expiratory flow rate (FEF25–75 L/s) were measured before and after thoracotomy. All measurements were made using a digital mobile spirometer device (SP10, Contec Medical, China) with standard practice in line with the American Thoracic Society recommendations [18]. Each parameter was measured three times, and the average value was recorded.

Thoracotomy Patient Education Booklet

As the educational tool, a printed educational material, one of the current methods used in patient education, was used. The education with the printed material was administered using a "Thoracotomy Patient Education Booklet," which was written out in a simple language, supported by pictures and easily readable. While preparing the booklet, the approaches for planning and administering patient education recommended by Rega MD [19] to nurses were taken into account. In this framework, the needs of the patients during the operation were examined, instructional objectives were determined, instructional methods and tools were determined, and the learning and teaching process was planned. The content of the booklet included information about the healthcare team members, function of the lung, lung cancer, and the surgical method. The booklet also provided information about the preparations the patients needed before surgery and what they needed to do during the operation day, after surgery, during discharge, and during the care process at home.

Data Analysis

In the analysis of the data, mean score and ± standard deviation values were given as descriptive statistics. Categorical variables were defined in numbers (n) and percentages (%). Student t tests were used for comparison of numerical data between two groups. The Spearman rank correlation coefficient was used to test the relationships between the ordinal variables. The chi-square test and Fisher's exact chi-square test were used to test the relationships among the categorical variables. Analyzes were performed in the Statistical Package for the Social Sciences (SPSS) 22.0 package program (IBM Corp., Armonk, NY, USA), and $p < 0.05$ was considered statistically significant.

Results

The mean age of the patients participating in the study was determined as 61.68 ± 8.80 years (min = 22 and max = 82). The mean age of the control group was 60.90 ± 11.56 years, while the mean age of the intervention group was 62.47 ± 4.77 years. There was no statistically significant difference between the groups ($p > 0.05$). The surgery technique for all patients in control and experimental groups was posterolateral thoracotomy. In the control and intervention groups, it was determined that the smoking period was over 30 years. The duration of smoking in the control group was 31.93 ± 24.75 years, while it was 31.30 ± 12.02 years in the intervention group. The difference between the groups was not statistically significant ($p > 0.05$). The distribution of independent categorical variables in the control and intervention groups was found to be homogeneous ($p > 0.05$). Distribution and statistical significance of independent categorical variables among the groups are shown in Table 1.

There was no statistically significant difference in the pain severity and pain duration felt when resting, coughing, and mobilizing in bed between the study groups before operation ($p > 0.05$). However, the pain severity and pain duration felt by the intervention group when resting, coughing and mobilizing in bed were significantly lower than those felt by the control group ($p < 0.05$). Comparison of the pain severity and pain duration between the groups before and after surgery is shown in Table 2.

Pain frequency was assessed preoperatively and postoperatively in the study groups. The patients' postoperative pain frequency was found to be constant (93.3%). There was no statistically significant difference between the groups in terms of preoperative and postoperative pain frequency ($p > 0.05$) (Table 3).

Pain types were assessed preoperatively and postoperatively in the study groups. There was no preoperative pain complaint in 51.6% of the patients in the control and intervention groups. The type of pain most frequently felt by the patients after surgery was "stinging" (56.6%). There was no significant difference between the control and intervention groups in terms of pain type before and after surgery ($p > 0.05$). Distribution and comparison of pain frequency and pain types between the study groups before and after surgery are shown in Table 3.

No statistically significant difference was found between the preoperative state anxiety inventory scores of the study groups ($p > 0.05$). The postoperative state anxiety level of the intervention group was found to be statistically lower than that of the control group ($p < 0.05$). No statistically significant difference was found between the preoperative and postoperative trait anxiety inventory scores of the study groups ($p > 0.05$). Comparison of the state and trait anxiety levels between the groups before and after the operation is shown in Table 4.

No statistically significant difference was found between the proportions of patients with respiratory distress, peripheral cyanosis, coughing, and wheezing in the study groups before surgery ($p > 0.05$). In the postoperative period, five patients had respiratory distress in the intervention group, while 14 patients had respiratory distress in the control group. The rate of patients with postoperative respiratory distress in the intervention group was significantly lower than that in the control

Table 1 Comparison of independent variables between the study groups

Independent variables	Properties	Control ($n = 30$)		Intervention ($n = 30$)		Total ($n = 60$)		Statistical significance
		n	%	*n*	%	*n*	%	χ^2/p
Gender	Female	1	(3.4)	5	(16.6)	6	(10.0)	p 0.195*
	Male	29	(96.6)	25	(83.3)	54	(90.0)	
Marital status	Married	28	(93.3)	27	(90.0)	55	(91.6)	p 1.000*
	Single	2	(6.4)	3	(10.0)	5	(8.4)	
Treatment status	Receive tereatment	3	(10.0)	3	(10.0)	6	(10.0)	p 1.000*
	Not receive treatment	27	(90.0)	27	(90.0)	54	(90.0)	
Resection type	Pneumonectomy	5	(16.6)	5	(16.6)	10	(16.6)	χ^2 0.12, p 0.943
	Lobectomy	20	(66.6)	19	(63.3)	39	(65.0)	
	Segmentectomy	0	(0.0)	0.0	(0.0)	0.0	(0.0)	
	Wedge resection	5	(16.6)	6	(20.0)	25	(18.3)	
Resected lobe	Upper lobe	11	(36.6)	13	(43.3)	24	(40.0)	χ^2 1.21, p 0.751
	Middle lobe	1	(3.3)	0	(0.0)	1	(1.6)	
	Lower lobe	13	(43.3)	12	(40.0)	25	(41.6)	
	All	5	(16.6)	5	(16.6)	10	(16.6)	
Family history	Yes	17	(56.6)	18	(60.0)	35	(58.3)	χ^2 0.07, p 0.793
	No	13	(43.3)	12	(40.0)	25	(41.6)	
Operation side	Right	14	(46.6)	15	(50.0)	29	(48.3)	χ^2 0.07, p 0.796
	Left	16	(53.3)	15	(50.0)	31	(51.6)	
BMI	Normal	17	(56.6)	14	(46.6)	31	(51.6)	χ^2 1.11, p 0.575
	Overweight	9	(30.0)	9	(30.0)	18	(30.0)	
	Obese	4	(13.3)	7	(23.3)	11	(18.3)	
Smoking status	Still smoke	9	(30.0)	7	(23.3)	16	(26.6)	χ^2 1.52, p 0.679
	Quit < 1 year	14	(46.6)	12	(40.0)	26	(43.3)	
	Quit > 5 year	4	(13.3)	5	(16.6)	9	(15.0)	
	Not smoked	3	(10.0)	6	(20.0)	9	(15.0)	
Alcohol usage	Yes	3	(10.0)	4	(13.3)	7	(11.6)	p 1.000*
	No	27	(90.0)	26	(86.6)	53	(88.3)	
Education	Primary school	16	(53.3)	20	(66.6)	36	(60.0)	χ^2 1.35, p 0.719
	Secondary school	4	(13.3)	2	(6.6)	6	(10.0)	
	High school	6	(20.0)	5	(16.6)	11	(18.3)	
	College	4	(13.3)	3	(10.0)	7	(11.6)	

χ^2 chi-square test, *BMI* body mass index

*P value achieved Fisher's exact chi-square test

Table 2 Comparison of the levels of pain severity and pain duration felt by the patients between the study groups before and after surgery while resting, coughing and mobilizing

			Control ($n = 30$) Mean ± SD	Intervention ($n = 30$) Mean ± SD	Statistical significance t/p
Preoperative	Pain severity	Resting	0.92 ± 1.08	0.87 ± 1.29	t 0.16, p 0.871
		Coughing	1.87 ± 1.60	1.82 ± 1.44	t 0.13, p 0.899
		Mobilizing in bed	2.10 ± 1.67	2.03 ± 1.13	t 0.18, p 0.857
	Pain duration (h)		0.53 ± 0.67	0.51 ± 0.62	t 0.10, p 0.921
Postoperative	Pain severity	Resting	7.13 ± 1.87	5.48 ± 1.59	t 3.68, p 0.001*
		Coughing	8.83 ± 1.19	8.12 ± 1.32	t 2.20, p 0.032*
		Mobilizing in bed	8.60 ± 1.27	7.40 ± 1.70	t 3.09, p 0.003*
	Pain duration (h)		6.96 ± 1.79	5.83 ± 2.17	t 2.21, p 0.031*

t Student *t* test, *SD* standard deviation

*$p < 0.05$

Table 3 Distribution and comparison of the pain frequency and pain types between the study groups before and after surgery

		Control ($n = 30$)		Intervention ($n = 30$)		Total ($n = 60$)		Statistical significance
		n	%	*n*	%	*n*	%	χ^2/p
Preoperative pain frequency	Intermittent	11	(36.6)	10	(33.3)	21	(35.0)	χ^2 0.08, *p* 0.961
	Constant	4	(13.3)	4	(13.3)	8	(13.3)	
	None	15	(50.0)	16	(53.3)	31	(51.6)	
Postoperative pain frequency	Intermittent	2	(6.6)	2	(6.6)	4	(6.6)	*p* 1.000*
	Constant	28	(93.3)	28	(93.3)	56	(93.3)	
Preoperative pain type	Sharp	2	(6.6)	2	(6.6)	4	(6.6)	χ^2 2.21, *p* 0.697
	Stinging	3	(10.0)	2	(6.6)	5	(8.3)	
	Burning	5	(16.6)	8	(26.6)	13	(21.6)	
	Pricking	5	(16.6)	2	(6.6)	7	(11.6)	
	None	15	(50.0)	16	(53.3)	31	(51.6)	
Postoperative pain type	Sharp	7	(23.3)	7	(23.3)	14	(23.3)	χ^2 0.00, *p* 1.000
	Stinging	17	(56.6)	17	(56.6)	34	(56.6)	
	Burning	6	(20.0)	6	(20.0)	12	(20.0)	

χ^2 chi-square test

**P* value achieved Fisher's exact chi-square test

Table 4 Comparison of the preoperative and postoperative state and trait anxiety levels between the groups

	Anxiety type	Control ($n = 30$) Mean ± SD	Intervention ($n = 30$) Mean ± SD	Statistical significance *t/p*
Preoperative	State anxiety	39.80 ± 7.10	40.67 ± 11.04	*t* − 0.36, *p* 0.719
	Trait anxiety	42.73 ± 5.56	42.97 ± 6.59	*t* − 0.15, *p* 0.883
Postoperative	State anxiety	40.63 ± 11.57	32.03 ± 6.87	*t* 3.50, *p* 0.001*
	Trait anxiety	44.13 ± 5.65	44.33 ± 6.03	*t* − 0.13, *p* 0.895

t Student *t* test, *SD* standard deviation

* $p < 0.05$

group ($\chi^2 = 6.24$, $p = 0.012$). There was no statistically significant difference between the groups in terms of postoperative peripheral cyanosis, coughing, and wheezing ($p > 0.05$).

There was no statistically significant difference between the control and intervention groups in terms of PEF, FVC, FEV1, and FEF25–75 values before surgery ($p > 0.05$). There was no statistically significant difference between the PEF and FVC values of the patients in the control and intervention groups after surgery ($p > 0.05$). However, the postoperative FEV1 (%) and FEF25–75 values of the patients in the intervention group were significantly higher than in the control group ($p < 0.05$). Comparison of the PEF (%), FVC (%), FEV1 (%), and FEF25–75 L/s values of the patients between the study groups is shown in Table 5.

Table 5 Comparison of the PEF (%), FVC (%), FEV1 (%), and FEF25–75 L/s values of the patients between the study groups

		Control ($n = 30$) Mean ± SD	Intervention ($n = 30$) Mean ± SD	Statistical significance *t/p*
Preoperative	PEF (%)	90.00 ± 26.00	88.90 ± 23.50	*t* 0.87, *p* 0.317
	FVC (%)	95.50 ± 13.90	94.10 ± 11.50	*t* 0.46, *p* 0.651
	FEV1 (%)	81.70 ± 18.80	82.70 ± 16.10	*t* − 0.228, *p* 0.820
	FEF25–75 (L/s)	3.36 ± 0.51	3.49 ± 0.60	*t* − 0.95, *p* 0.344
Postoperative	PEF (%)	31.50 ± 18.60	37.20 ± 15.20	*t* 0.71, *p* 0.199
	FVC (%)	46.70 ± 16.90	51.90 ± 10.60	*t* − 1.50, *p* 0.138
	FEV1 (%)	36.20 ± 12.80	42.70 ± 10.40	*t* − 2.17, *p* 0.035*
	FEF25–75 (L/s)	1.12 ± 0.53	1.48 ± 0.48	*t* − 2.72, *p* 0.009*

t Student *t* test, *SD* standard deviation

* $p < 0.05$

Discussion

Considering the clinical course in the postoperative period, it is important to periodically inform patients, who will undergo pulmonary resection, within a plan. Patients learn about their general health status, treatment, and recovery process through the health education offered to them [12]. It is known that patients manage their treatment processes better with a specially planned education [20]. Since patient education positively affects the general clinical situation of patients [13], research evaluating the effectiveness of patient education in nursing care in different surgical fields carries value.

Since anxiety and pain are closely related concepts [7], often pain is also assessed in studies that investigate the anxiety factor [21, 22]. There are studies in the literature that evaluate the effect of health education on pain and anxiety of patients who will undergo general surgery [23] and cardiac surgery [24, 25]. It was determined that the verbal education given to patients who would undergo surgery in the general surgery department reduced the state anxiety after surgery but did not have any effect on the pain and trait anxiety [23]. Guo et al. [24] stated that the education they gave to patients, who would undergo cardiac surgery, using an educational booklet significantly reduced the anxiety level but did not have any effect on pain. Asilioglu et al. [25] found that the planned education given using an educational booklet before open heart surgery did not have any positive effect on the state-trait anxiety level.

In the literature, there are few studies evaluating pain and anxiety in patients who are scheduled for pulmonary resection. It was determined that a specially planned 45-min verbal education for thoracotomy patients significantly reduced the level of pain and the amount of postoperative analgesic use [26]. On the other hand, Madani et al. [27] performed a multidisciplinary treatment plan, including a patient education program given through an educational booklet, on patients to undergo lobectomy and found that the duration of stay in the hospital was significantly reduced in the group who was educated. In this study, it was determined that the state anxiety level, pain severity, and pain duration were significantly lower in the study group receiving health education using the education booklet than in the control group. The reduction in anxiety and pain severity in the group receiving education may have been due to the clinical information about the intensive care unit and the hospitalization process in the education booklet.

Depending on the pathologic spread, some or all of the lungs is removed through pulmonary resection. Loss of lung tissue negatively affects respiratory functions. In addition to pulmonary resection, general anesthesia and pulmonary resection type also affect pulmonary capacities [9]. Postoperative FEV1 and FVC values of the patients who underwent lobectomy and wedge resection were found to be higher than those of the pneumonectomy patients [28]. It is stated that after pulmonary resection, it can take a year for respiratory functions to recover [29]. In this study, all of the patients' operations were performed under general anesthesia. It was determined that FVC (%), FEV1 (%), and FEF25–75 (L/s) values of the patients in the control and intervention groups were significantly decreased after surgery compared to the preoperative level. In addition, the postoperative FVC (%) and FEV1 (%) values of the control and intervention groups were much lower than those of the previous studies proceeded on thoracotomy patients. In previous studies, spirometric measurements were made at least 1 month after the operation and in discharged period [9, 28, 29]. The reason why the FVC (%) and FEV1 (%) values in this study were lower than those of the previous studies may be due to the fact that spirometric measurements were performed 24 h after the patient was taken to the service and that the pain severity and duration of patients in this period was much higher than the period after discharge.

It was reported that pulmonary exercises taught to the patients in the preoperative period were effective in preventing pulmonary complications [30]. However, no study could be found in the literature review that investigates the effect of patient education through booklets on respiratory capacities of patients who would undergo thoracotomy. The postoperative FEV1 (%) and FEF25–75 (L/s) values of the group who received education were found to be statistically higher than the control group. The information given about positioning and breathing exercises in the patient education booklet may have contributed to the higher values of FEV1 (%) and FEF25–75 (L/s) compared to those of the control group.

In this study, the postoperative pain severity, pain duration, and state anxiety levels were statistically lower in the group receiving education through the thoracotomy patient education booklet than in the control group. Furthermore, the postoperative FEV1 and FEF25–75 values of the patients in the intervention group were found to be significantly higher. We believe that the data that we obtained will be useful for patient education strategies that will be developed for patients who are planned to undergo pulmonary resection.

Compliance with Ethical Standards

Prior to the study, permission was obtained from the Sanko University Clinical Research Ethics Board (protocol number 03.2016/4, date 21 October 2016) and from the chief physician of the hospital. Patients were informed about the purpose and method of the study, and their written consents regarding their voluntary participation were obtained.

Conflict of Interest The authors declare that they have no conflict of interest.

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