

The Effect of Cold Vapor Treated to Thyroidectomy Patients During Early Postoperative Period

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ABSTRACT

Although thyroidectomy is one of the operations that are frequently performed with a low mortality rate today, it may cause severe morbidity, bleeding, recurrent damage of neuronal and parathyroid glands and problems such as laryngeal edema.

Objectives: In this analytical and prospective study, it was aimed to examine the effect of cold vapor that was applied to thyroidectomy patients during early postoperative period.

The sample of the study was composed of 60 patients who underwent thyroidectomy. Patients were classified into two groups including control group and cold vapor group. Cold vapor was applied to both groups vapor for 15 minutes per hour within the first eight hours following the operation. Then, for cold vapor group cold vapor application was continued to apply at two and three hour intervals during the first 24 hours. In both groups sore throat, cough, dysphagia and vocal status were evaluated in the first 24 hours after surgery.

It was determined that sore throat was experienced significantly less in cold vapor group within the first 24 hours following operation and it was increasingly cooling down. It was also found that cough was experienced significantly less in cold vapor group, and this problem disappeared completely at 8 hours after the operation. Cold vapor applied during the first 24 hours following thyroidectomy was found to have had a significant effect on decreasing swallowing impairment and eliminating hoarseness.

Cold vapor application during the first 24 hours following operation was found to have an effect on alleviating sore throat, cough and swallowing impairment and eliminating hoarseness.

Key Words: Cold vapor, Sore Throat, Thyroidectomy

Introduction

Thyroidectomy is one of the surgical interventions that is frequently used for the treatment of thyroid disease which can not be treated with medical therapy. Surgical interventions are used for many malignant and benign conditions of thyroid disease. Surgery and nursing care of thyroid gland, which is an important endocrine organ due to its functions, anatomic placement and neighborhood, requires a special knowledge and proficiency (1).

Although thyroidectomy is one of the operations, which are frequently performed with a low mortality rate today, it may cause severe morbidity, bleeding, recurrent damage of neuronal and parathyroid glands and problems such as laryngeal edema (2,3). Pain is one of the early signs of these problems. The incidence of sore throat following the surgery was reported to be ranging between 14.4% and 98% in many reports; and to be higher among the patients who underwent thyroid surgery compared to the other operations (2,3,4). The other problems that may be often encountered following the surgery are throat dryness, difficulty in breathing and swallowing, cough

and hoarseness. Mucosal injuries on vocal cord or trachea during intubation, excessive drag of the tube between larynx and pharynx, contact of the tube's cuff with the tracheal area, dry anaesthetic gases, the effects of the surgical procedure performed on the region, the size and the shape of intubation tube, difficulty experienced during intubation and excessive oropharyngeal aspirations are among the causes of these challenges (2,5).

Cool and dry anaesthetic gas reaches the airways directly during the mechanical ventilation following endotracheal intubation. In this case, a reduction to be seen in the temperature and humidity of respiratory tracts (2,5,6). When the humidity level of respiratory tracts goes down below a certain value, mucus decreases. There is a loss in the number of cilia and the functions of cells covering respiratory tract mucosa owing to the reduction in mucus. Inflammation occurs as a result of this. Further keratinizations, ulcerations and necroses may even develop on the epithelial layer of respiratory tract and trachea with the reduction of humidity in the airways (7,8).

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Due to these problems that can be experienced following thyroidectomy, the use of non-pharmacological methods besides medication treatments gains importance for the elimination of such problems during patient care process. Cold vapor application is one of the non-pharmacological methods used during postoperative period (2,3,8,9). Cold vapor provides humidification of the airways. Cold vapor, which is applied regularly and intermittently especially during postoperative period, may eliminate sore throat; and it may also alleviate pulmonary complications. Expectoration is difficult in the presence of tracheal secretions with escaled viscosity. This condition, which is commonly observed during postoperative period, causes an increase in the pulmonary complications. Cold vapor can also be used to facilitate expectoration (10).

Cold vapor application creates vasoconstriction in the veins around the region of treatment; and thus, it decreases metabolic rate and alleviates edema in this region. When muscle temperature decreases with cold vapor, a reduction occurs in the tensile sensitivity of muscle spindles with the reflex effect of heat receptors; or it decreases muscle spasm by providing inactivation of the trigger points on muscles. Moreover, cold vapor reduces skin sensitivity by lowering the temperature of nerve fibers and receptors (11).

The effect of cold application occurs in three stages. The patients feel coldness within the first three minutes with the beginning of cold vapor application; they feel pain with burning within the next five minutes; and abirritation or pain alleviation occurs after ten minutes. During this process, spasm and pain alleviation occur with the decrease in the transmission of nerve fibers found in that region. Metabolic rate gains momentum and reflex vasodilatation occurs in deep tissue during 12 to 15 minutes of cold vapor application. As a result, pain and edema alleviate and tissue is supplied blood with the vasodilatation occurring after 15 minutes (12).

Jung et al. reported that humidification of throat with vapor following thyroidectomy decreased sore throat and cough; and Bulut et al. reported that cold vapor was effective in decreasing fever, airway inflammation and viscosity of secretions, and could be used in the control of complaints such as hoarseness associated with larynx damage, cough and throat dryness (2,9). Postoperative sore throat has been frequently observed in the surgical clinics. In the literature, there are limited number of studies on cold vapor application for eliminating sore throat in surgical clinics.

This study was carried out to determine the effect of cold vapor applied to thyroidectomy patients during

early postoperative period on sore throat, swallowing impairment, cough and hoarseness.

Materials and Methods

Design: This study was analytical in view of causality, descriptive of data collection method, prospective of timing and clinical of the environment where it was conducted.

Setting: This study was carried out in the General Surgery service of a Health Application and Research Center located in Western Black Sea region between 07.01.2017 and 07.01.2018. In the clinic, cold vapor was routinely applied to the patients for 15 minutes per hour within the first 8 hours following thyroidectomy. Oral feeding was initiated at 8 hours following the surgery.

Sample: The universe of the study was composed of 123 patients who underwent thyroidectomy within the last year. The sample of the study consisted of 60 patients including 30 in the study group and 30 in the control group. When sample power was assessed according to the differences between groups in terms of pain levels, the effect size was found as 1.63 and power was 99%. Sample inclusion criteria included patients who were older than 18 years old, underwent thyroidectomy operation, were conscious, did not have any respiratory problems (such as chronic obstructive pulmonary disease and asthma), not develop any complications during the operation, not have any communicational problems and were willing to participate in the study. Patients did not undergo otorhinolaryngological examination before the surgery. Patients, who did not have an ear-nose-throat problem according to their own declaration, were not included in the study. Patients who did not have a history of radiotherapy on the head-neck region and who did not present vocal cord paralysis were included in the sample. The patients in the sample were nonsmokers. ASA scores of all patients were ASA II; and tramadol hydrochloride and paracetamol were included in the treatment of pain.

Data Collection Instruments: Patient Data Collection Form, Numerical Rating Scale (Pain States) Form, Swallowing Impairment Score (SIS) Form, Cough Severity Form, Voice Handicap Index10 Form were used to collect data.

Patient Data Collection Form: This form which was prepared in accordance with the relevant literature includes demographic and clinical characteristics of the patients. Furthermore, the size of intubation tube, intubation time, ASA (American Society of Anesthesiologists) score and analgesia treatment were recorded in this form.

Numerical Rating Scale (Pain States) Form: Numerical rating scale from 0 to 10 was used to assess pain severity of the patients. In this scale, “Zero” defines “absence of pain” and “10” defines “the highest intolerable pain”.

Cough Severity Form: In this form which was prepared in accordance with the relevant literature (2,3), the severity of cough was assessed as 0=no cough, 1=Discomfort like itching (tickling), 2=mild cough, 3=moderate cough, 4=Intense cough.

Swallowing Impairment Score (Sis) Form: Scoring system that evaluates the difficulty in swallowing includes 6 questions as 1=swallowing requires effort, 2=I feel as if something was inserted into my throat during swallowing, 3=I feel discomfort during passage from my throat, 4=I cough while I am swallowing, 5=I feel as if there was a foreign object in my throat, 6=I feel difficulty while swallowing liquids. Each question is scored between 0 and 4; and the presence of swallowing impairment is evaluated subjectively (10). The elevation of SIS score, which varies between 0 and 24, shows that swallowing impairment is high.

Voice Handicap Index (Voice Handicap Index 10) Form: Voice Handicap Index developed by Jacobson et al.; is a subjective report by the patients themselves and is the most commonly used method for evaluating patients with voice problems. The short version of Voice Handicap Index consists of 10 items (13). Three of them take part in the functional subgroup, other three in the physical and the remaining four in the emotional subgroups. The patient gives a score between 0 and 4 for each item. As the score grows higher, it means the problem is more serious. While Cronbach Alpha value of Voice Handicap Index is 0.97; it was found to be 0.90 in this study.

Intervention: Patients were divided into two groups including cold vapor group (n=30) and control group by simple randomization method (n=30). The interventions, which were performed within the first 8 hours following the surgery for both groups, were application of cold vapor for 15 minutes per hour, 2 lt/min of O₂ therapy via a nasal cannula for a maximum of 2 hours according to the general condition of the patient, and the evaluation of sore throat and severity of cough at 2 hour intervals in accordance with the relevant literature (5,9). Cold vapor application was maintained for cold vapor group at two and three-hour intervals including 8, 10, 12, 15, 18, 21 and 24 hours following postoperative 8 hours whereas control group did not get this treatment. Sore throat, swallowing impairment and cough severity of the patients in both groups were evaluated at 8, 10, 12, 15, 18, 21 and 24 hours following

operation. Hoarseness was assessed in both groups at postoperative 24 hours.

Ethical Considerations: Ethics approval was obtained from the Clinical Research Ethics Committee of the university where the study was conducted (Protocol No:2017/12). In order to use Turkish versions of swallowing impairment score and voice handicap index in the study permissions were taken from the authors, who carried out validity and reliability studies of the Turkish versions of them. An authorization was taken from the center where the study would be conducted. Patients who would be included in the sample were instructed about the aim of the study; and informed written consent forms were obtained from them through voluntary participation.

Data Analysis: A licensed statistical program was used for statistical analyses. Data were analyzed using NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA). Descriptive statistical methods (mean, standard deviation, median, frequency, percentage, minimum, maximum) were used to assess data of the study. Conformity of quantitative data to normal distribution was tested by Shapiro-Wilk test. Quantitative variables were compared by Student t test and Mann-Whitney U test. Pearson Chi-Square test was used for the comparison of qualitative data. The results of the study were assessed at a confidence interval of 95% and a significance level of $p < 0.05$.

Limitations: The number of aspirations, cuff pressure value, mallampati scoring and the number of intubation trials were not evaluated for all patients in the sample. All patients in the experimental and control groups were given 2lt/min O₂ through a nasal cannula up to 2 hours according to their general conditions. The duration of oxygen application was not extended, and this constituted a limitation for this study.

Results

It was found in the study that mean age was 45.07 ± 12.88 and 49.60 ± 11.70 years old; 53.3% and 70% were females and 73.3% and 76.7% did not have any chronic disease in the cold vapor and control group, respectively (Table 1).

It was determined that half of the patients in both groups had undergone lobectomy and the other half had undergone total thyroidectomy surgery. The mean size of intubation tube among the patients was found to be 7.34 ± 0.24 mm and 7.43 ± 0.18 mm in cold vapor and control groups, respectively. Also, mean time of intubation was found to be 2.32 ± 0.25 hours and 2.43 ± 0.17 hours in cold vapor and control groups, respectively; and intubation time was

significantly shorter in cold vapor group compared to the control (Table 1).

At first evaluation following surgery (hour 0), mean pain score of cold vapor group was 3.50 ± 1.11 ; and it was 6.13 ± 2.27 in control group. Pain scores were found to be 1.07 ± 0.69 in the cold vapor group and 3.87 ± 2.11 in control group during the evaluation at 24 hours following the operation. At all evaluation times, pain scores of the patients in cold vapor group were found to be significantly lower than the other group. In addition pain scores showed a decrease in both groups (Figure 1).

At first evaluation following surgery (hour 0), cough severity score of cold vapor group was 0.07 ± 0.37 and it was 1.23 ± 1.10 in the control group. It was also found that cough score of the group, to which cold vapor was applied at 8 hours following the surgery, was zeroized; and it was found to decline to 1.17 ± 1.05 in the control group at 24 hours. At all evaluation times, cough severities of the patients in cold vapor group were found to be significantly lower than the other group (Figure 2).

At the first evaluation following surgery (8th hour), swallowing impairment of cold vapor group was 1.37 ± 1.27 ; and it was determined to be 9.63 ± 4.67 in the control group. In the evaluation at postoperative 24 hours, mean swallowing impairment score of cold vapor group was found to be 1.00 ± 1.17 ; and it was 7.73 ± 4.19 in the control group. At all evaluation times, swallowing impairment scores of the patients in cold vapor group were found to be significantly lower than the other group (Figure 3).

While hoarseness was observed among 26.7% of the cold vapor group, it was stated that 70% of the control group had hoarseness. The ratio of hoarseness and Voice Handicap Index score in cold vapor group were found to be statistically lower than the control group (Table 2).

Discussion

Patient-associated factors also affect postoperative sore throat, cough, swallowing impairment and hoarseness besides the anaesthesia and type of the surgery (6). During postoperative period, sore throat is often experienced during the first hours and gradually decreases. In the study by Yang et al., it was reported that patients mostly experienced postoperative sore throat at first hour; and Jaensson et al. reported the highest postoperative sore throat was suffered at 2nd and 6th hours (14,15). At the end of this study, postoperative pain levels of the patients peaked at second hour in cold vapor group and at 4th hour in the control group; and these results show

similarity with the literature. Having anaesthesia through inhalation method, extension of operation time and increase in the exposure to endotracheal tube are the parameters increasing sore throat. Previous studies showed that sore throat experienced by the patients, whose operations lasted more than one hour, was 1.5- times more than the ones whose operations lasted shorter (3). In this study, intubation duration of the patients in cold vapor group were found to be significantly shorter. During 24-hour follow-up period, pain scores decreased in both groups; and pain scores were determined to be significantly lower in cold vapor group compared to control group. It was thought that as the operation time lengthened out, it could be more likely to suffer sore throat by patients. Ulcers or erosions may develop in larynx even after a short intubation period. This risk increases with the extension of intubation time. Healing occurs generally fast in superficial wounds (16,17).

In the literature, it has been reported that the size of intubation tube may affect sore throat. Xu et al. reported that using a small size intubation tube during thyroid surgeries decreased the incidence and severity of postoperative sore throat among female patients (18). In addition, Kadri et al. reported a higher incidence of postoperative sore throat among the patients for whom intubation tubes, that were equal or greater than 7.5 mm, were used during thyroid operations (3). The incidence of postoperative sore throat was reported to be higher following thyroid operations due to the movement of endotracheal tube inside the trachea more (4). The results of this study suggested that as the sizes of intubation tubes were significantly smaller among the females in cold vapor group, they might experience less sore throat.

Cold vapor is a non-pharmacological method which can be used to decrease postoperative sore throat and cough. Cough reflex is important to protect upper respiratory tracts from foreign objects and accumulation of mucus; but, cough occurring after intubation is disturbing. Mechanical damage brought on the larynx by the placement of endotracheal tube, harmful stimuli arising from surgery, the effect of anesthetic medications and possible involvement of different mechanisms cause cough reflex (19,20). Cold vapor application prevents mucus accumulation by decreasing inflammation and as a result, cough reflex is not stimulated.

In their study, Jung et al. reported that sore throat was less common among the patients whose throats were humidified with vapor at postoperative 6, 24 and 48 hours compared to the ones who did not get any vapor treatment; and so throat humidification was an effective method that might prevent postoperative

Table 1. Distribution of Patients' Demographics and Clinical Characteristics

		Cold Vapor Group (n=30)	Control group (n=30)	Test value p
Age (years)	Min-Max	28-78	28-70	t=-1.427
	$\bar{x} \pm SD$	45.07±12.88	49.60±11.70	a0.159
Gender; n (%)	Female	16 (53.3)	21 (70.0)	X2 =1.763
	Male	14 (46.7)	9 (30.0)	b0.184
Education Level; n (%)	Elementary School	7 (23.3)	18 (60.0)	X2=8.406 b0.015*
	Graduates of High School	12 (40.0)	7 (23.3)	
	University	11 (36.7)	5 (16.7)	
Marital status; n (%)	Married	17 (56.7)	25 (83.3)	X2=5.079
	Single	13 (43.3)	5 (16.7)	b0.024*
Job; n (%)	Unemployed	4 (13.3)	14 (46.7)	X2=9.185 b0.027*
	Self-employment	7 (23.3)	6 (20.0)	
	Retired	8 (26.7)	6 (20.0)	
Chronic disease status; n (%)	Officer	11 (36.7)	4 (13.3)	X2=0.089 b0.766
	Yes	8 (26.7)	7 (23.3)	
Type of surgery; n (%)	No	22 (73.3)	23 (76.7)	X2=0.001 b1.000
	Lobectomy	15 (50.0)	15 (50.0)	
Size of intubation tube in women (mm)	Total thyroidectomy	15 (50.0)	15 (50.0)	t=-1.186 a0.246
	Min-Max	7-7.5	7-7.5	
Size of intubation tube in men (mm)	$\bar{x} \pm SD$	7.34±0.24	7.43±0.18	Nonsignificant
	Min-Max	8-8	8-8	
Intubation time (hour)	Min-Max	2-2.5	2-2.5	t=-2.131 a0.038*
	$\bar{x} \pm SD$	2.32±0.25	2.43±0.17	

\bar{x} =Mean, SD=Standard deviation, t = aStudent t Test, X2= bPearson Chi-Square Test, *p<0.05

Table 2. Comparison of Voice Handicap Index Scores between Cold Vapor and Control Groups

		Cold Vapor Group (n=30)	Control Group (n=30)	Test value p
Voice Handicap Index Scores	Min-Max	0-2	0-21	Z=-4.172
	$\bar{x} \pm SD$	0.30±0.53	4.60±5.24	c0.001**
	Hoarseness	8 (26.7)	21 (70.0)	X2=11.279
	No hoarseness	22 (73.3)	9 (30.0)	b0.001**

\bar{x} =Mean, SD=Standard deviation, X2= bPearson Chi-Square Test, Z= cMann Whitney U Test **p<0.01

sore throat and formation of cough (2). In the study by Bulut et al. who evaluated the sore throat among the patients to whom cold vapor and cold vapor with oxygen were applied following the operation, it was found that sore throat decreased at postoperative 12 hours, and there was not a statistically significant difference between the groups. In addition to this, the highest decrease in sore throat was found in the

group undergoing treatment of cold vapor with oxygen; and as a result, they reported that cold vapor given following the operation did not have any effect on sore throat alone (9). Moreover, Ozsoy also reported that cold vapor applied following the surgery did not have an impact on sore throat (5). As a consequence of this study, it was determined that sore throat was higher in the control group although cold

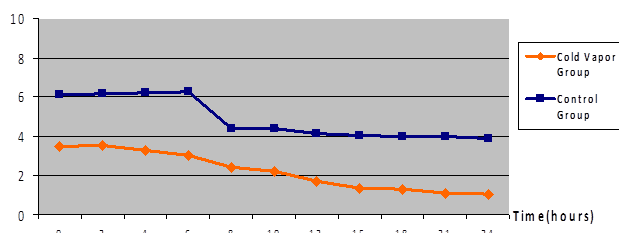


Fig. 1. Distribution of Sore Throat Condition among Groups

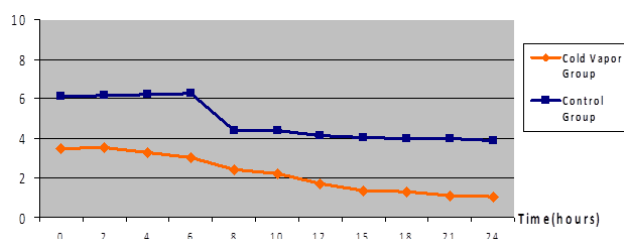


Fig. 2. Distribution of Cough Severity among Groups

vapour were applied to both groups within the first eight hours following the operation. Sore throat was observed to be significantly less in the group which was continued to take cold vapor application from postoperative 8 hours until 24 hours. This showed that cold vapor decreased the severity of pain at all levels. Subjective aspect of pain is as important as its objective aspect; and it should be evaluated. On the other hand, cold vapor may cause a possible undesirable hypothermia if it is not treated with a proper technique. Many factors are involved in the development of postoperative undesirable hypothermia. As a result of hypothermia, some problems may be seen such as the occurrence of postoperative myocardial events, delays in wound healing and increases in hospitalization time and costs (21).

Cough reflex is important to protect upper respiratory tracts from foreign objects and accumulation of mucus; however, cough that occurs after intubation is irritating (19, 20). Cough was reported in 16.7% of thyroidectomy patients in the study by Araujo et al. and in 22.85% in the study by Jiang et al. Intubation tube and high cuff pressure were regarded as the factors affecting the occurrence of postoperative cough in the literature (22,23). Bulut et al. reported that throat dryness was significantly decreased in the patients to whom cold vapor was applied in combination with oxygen at postoperative 4 and 8 hours, and cold vapor was effective in decreasing fever, airway inflammation and viscosity of secretions (9). Moreover, Jung et al. stated that humidification of throat with vapor had a significant effect on alleviating postoperative sore throat and coughing incidence and severity which occurred following thyroid surgery using endotracheal tube (2). As a

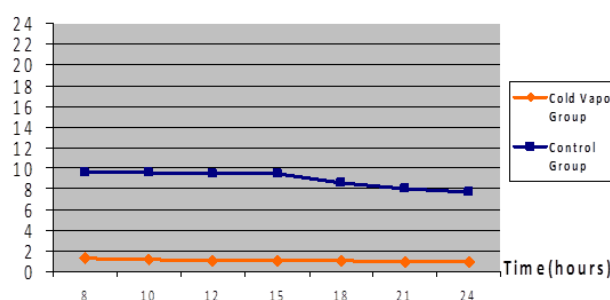


Fig. 3. Distribution of Swallowing Difficulties among Groups

consequence of this study, no cough problems occurred at postoperative 8 hours and later on among the patients to whom cold vapor was applied whereas cough problem continued albeit at a diminishing pace during 24 hours in the control group. These results were comparable with the relevant outcomes in the literature.

Swallowing impairment and hoarseness are among the most commonly observed laryngopharyngeal disorders following thyroidectomy (1,24). Swallowing impairment was reported among 20% of thyroidectomy patients in the study by Scerrino et al. and on the other hand 5.6% of the patients in the study by Sahli et al. (25,26). In the study in which they evaluated postoperative swallowing impairment following thyroid and parathyroid resection (n=372), Hillenbrand et al reported that 53 patients experienced swallowing process better and without any problems following thyroidectomy; 110 patients reported swallowing impairment just after the operation and it disappeared afterwards; 16 patients experienced swallowing impairment for three months following the operation; swallowing impairment was treated with a logopedic method successfully up to three months in one patient; and swallowing impairment persisted more than three months in 39 patients (27). Furthermore, Atasayar stated that 98.3% of the patients had difficulties in swallowing solid foods following thyroidectomy; and 95% of them experienced a discomfort during swallowing. In their study evaluating swallowing impairment at postoperative 8 and 12 hours, Bulut et al. reported that cold vapor reduced swallowing impairment in patients when given together with oxygen (9,28). As a consequence of the study by Ozsoy, it was determined that cold vapor application did not alleviate swallowing impairment during postoperative period (5). In this study, swallowing impairment states of the patients, who were initiated a diet at postoperative 8 hours, were observed to be significantly lower. Although both groups were treated with cold vapor application within the first 8 hours. it is odd enough that swallowing impairment was higher in control group. It was thought that this

situation in the control group could be stem from intubation time. Granulation may develop on vocal cords with the extension of intubation time. This condition may be asymptomatic in some patients as well as it may cause hoarseness, thorax pain, chronic cough and hemoptysis (16,17).

Hoarseness is one of the common complications following the surgery of thyroid gland (29). In the literature, many factors such as size of tracheal tube, cuff pressure and quality and intubation time have been described as the factors that may affect laryngeal damage and postoperative hoarseness (4,30). This complaint which varies from patient to patient; regresses within 24 to 72 hours (31,32). In the previous studies, 2% to 87% of the patients reported to suffer hoarseness following thyroid surgery (22,23,29).

In their study, Bulut et al. found that treatment of cold vapor in combination with oxygen alleviated hoarseness (9). Ozsoy indicated that cold vapor did not have any effects on hoarseness (5). The results of this study showed that the ratio of hoarseness was significantly lower in cold vapor group. Based on this, they suggested that cold vapor applied following the surgery was effective in reducing hoarseness.

In this study which is aimed to evaluate the effect of cold vapor applied within the first 24 hours following thyroidectomy, it was concluded that cold vapor had a significantly positive effect on eliminating sore throat, cough, swallowing impairment and hoarseness. However, the effect of intubation time on this effect can not be denied.

According to these results;

- Given that pain is subjective, it is required to be assessed with other objective findings such as vital signs,
- It is required to assess the factors that may affect sore throat such as number of intubation trials during the operation and the number of aspirations following the surgery,
- It is required to measure intubation cuff pressure since it has an effect on sore throat,
- It is suggested to conduct similar studies by a randomized controlled method.

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