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The effect of eucalyptus vapor on cough after coronary artery bypass surgery

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ABSTRACT

Cough is postoperative complication following endotracheal intubation as well as inflammation of the pharynx, larynx and trachea. The aim of this study was to evaluate the effect of eucalyptus vapor on cough after tracheal extubation in patients undergoing coronary artery bypass graft (CABG). In this randomized controlled trial, 100 patients undergoing CABG were randomly divided into two groups by accessible sampling. Before the intervention and after tracheal extubation, demographic and clinical data, as well as data on cough by a scoring system were collected from interventional and control groups. The patients in the interventional group after tracheal extubation were exposed to eucalyptus vapor for about 10 min. This treatment was performed at 1 and 12 h after extubation. The severity of cough was recorded in both interventional and control groups at 0, 1, 6, 12 and 24 h after extubation. The present study showed that the severity of cough after extubation in the patients undergoing CABG in the interventional group had no significant difference at the times of immediate to 24 hours after extubation. Risk of cough had respectively 9.5% increase in the control group as compared to the interventional group.

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Introduction

Cardiovascular disease (CVD) is on the rise in the world and the number of people experiencing CVD is estimated to reach 25 million by 2020(1). Mortality caused by this disease is 28.5% in developing countries and 40% in Iran, so that 150,000 Iranians die annually because of the diseases (2). Coronary artery disease is among the most common heart diseases; despite the effectiveness of current medical methods in the treatment, many patients may need vascular reconstruction (3). Patients undergo general anesthesia for open-heart surgery by anesthesiologist and subsequently are transferred directly to the ICU to emergence from anesthesia (4). Endotracheal intubation for airway control and respiratory protection is necessary in general anesthesia. Almost all patients who are intubated for during surgery experience some degree of airway damage (5). cough is the most common postoperative complications that occur after endotracheal intubation, as well as inflammation of the pharynx, larynx, and trachea (6). Cough can occur during and after extubation and causes a sudden increase in pressure within the body cavities. The incidence of this problem in patients with increased cerebral pressure is very dangerous. The incidence of cough in thoracic and abdominal surgery causes stretches the sutures in the surgical area and exacerbates the patient's pain (5).

So far, different pharmacological and non-pharmacological methods have been used to reduce the side effects of extubation, including the use of dexamethasone during extubation (7), lidocaine gel on the endotracheal tube (5, 8), betamethasone gel on the endotracheal tube cuff (4) and green tea gragling after extubation (9). Corticosteroid medications have anti-inflammatory effects, but their side effects should not be ignored, including high blood pressure, suppressing natural corticosteroids production and high blood sugar in diabetics. Lidocaine gel has also no anti-inflammatory properties and causes only local anesthesia. The use of plant such as eucalyptus with anti-inflammatory and anti-bacterial properties has very few side effects, which may be effective for the problem mentioned. Eucalyptus leaves are used today to treat influenza and the common cold as extracts and essential oils. Eucalyptus essential oils are obtained through distillation of the plant leaves. Eucalyptus essential oil contains 62% eucalyptol or 1,8-cineole, 24% pinene and alcohol, of which 1,8-cineole has an anti-inflammatory effect. The effects of Eucalyptus have been stduied in chronic obstructive pulmonary disease (10) and asthma (11); and the results have been impressive. Considering the mentioned features and effects, this plant seems to be effective in relieving the symptom of cough caused by intubation in patients

undergoing coronary artery bypass grafting. Therefore, this study was designed and conducted to evaluate the effect of eucalyptus vapor on cough after extubation in patients undergoing coronary artery bypass surgery.

Materials and Method

This research was approved by Ethical Committee of Mazandaran University of Medical Sciences (IR.MAZUMS.REC.94-1886) and registered in Iranian Registry of Clinical Trials (IRCT201512147494N16). This study is a randomized controlled trial. The sample size was calculated based on a pilot study (n = 20) in which intensity score (Likert 0 to 3 point scale, 3 = worst pain, 0 = least pain) was used to detect the effect of eucalyptus essential oil. In this pilot study a difference of 0.7 on this scale is considered clinically significant in favor of the patients who received eucalyptus essential oil. Therefore, the current study was powered to detect a mean difference in cough intensity of 0.7. Two groups of 37 patients were required on the basis that this provided at least 90% power, with an alpha level of 0.01, to detect a 14% absolute change in the mean sore throat intensity score. In order to account for an anticipated attrition rate of 25% we aimed to recruit 50 patients per group (Figure 1). In total, 100 patients underwent coronary artery bypass surgery at Fatemeh Zahra Hospital, Iran, with the inclusion criteria assigned randomly into two groups based on random numbers in Microsoft Excel RANDBETWEEN function and enrolled to the study as a sample after obtaining consent.

Inclusion criteria were age over 18 years, ability to communicate and answer questions, no drug addiction, use of unit endotracheal tube brand for intubation and satisfaction to participate in the study. Exclusion criteria included intubation more than once, Mallampati class higher than 2, airway anomalies, upper airway infection, respiratory diseases such as sinusitis, asthma and chronic obstructive pulmonary disease(COPD) (12), eucalyptus allergy history, people with allergies to eucalyptus, history of inflammatory diseases of the gastrointestinal tract or bile ducts, severe liver disease and taking barbiturates and amphetamines (13). Data collection tools included demographic characteristics and clinical questionnaires, and the scoring system of cough. The demographic and clinical questionnaire consisted of age, sex, history of smoking, history of surgery in the last month, number of attempts for intubation, extubation by the patient, laryngoscopy duration, frequency of suctioning (by suction catheter No. 12 with a direct view to prevent damage to the soft tissues), brand of tracheal tube, endotracheal tube size, endotracheal tube cuff pressure, duration of surgery and Mallampati score. Cough questionnaire included four items; zero: no cough, 1: mild cough (less than a common cold) 2: moderate cough (similar to a common cold) and 3: severe cough (more than a common cold).

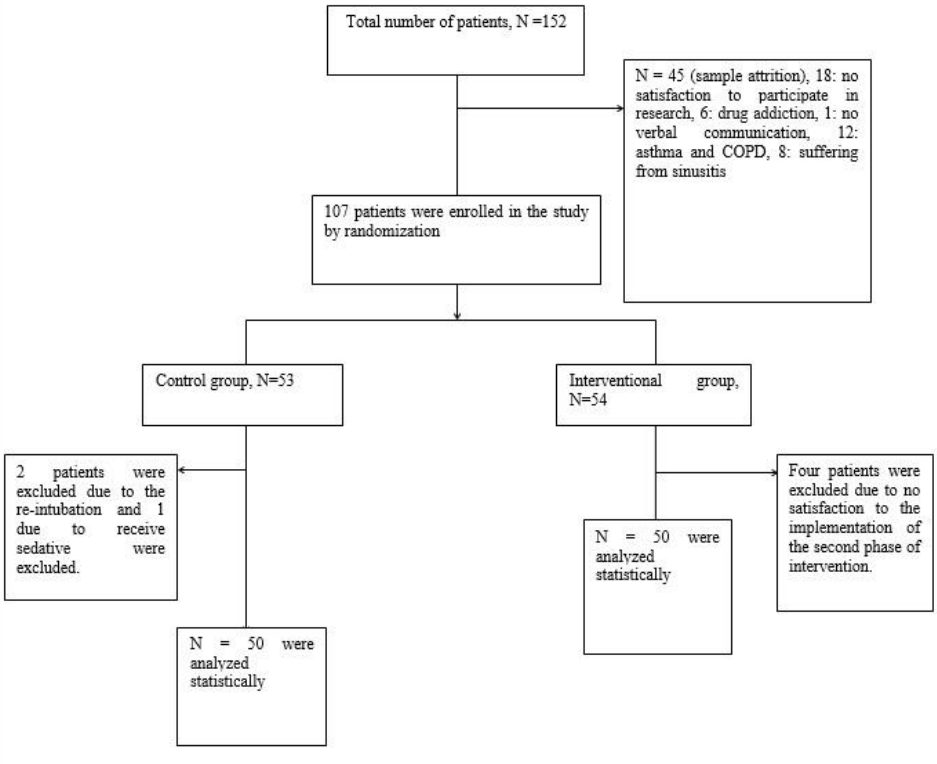

Figure 1 Consort flowchart

These questionnaires have been used frequently in previous studies (5, 9, 14, 15-17), and the reliability was estimated by Cronbach's alpha coefficient of 0.624 in the study.

The researcher referred to Fatemeh Zahra Hospital after obtaining the written agreement of the authorities and research ethics committee of Mazandaran University of Medical Sciences, Iran, and explained the purpose of the study after introducing herself as a researcher to the hospital authorities and patients. Next, written consent was obtained from patients undergoing coronary artery bypass grafting having inclusion criteria after extubation, regaining consciousness in the intensive care unit and ensuring the ability to communicate. Before the intervention and after tracheal extubation, data were recorded using scoring system of the severity of cough in the interventional and control groups. The patients in interventional group after tracheal extubation were exposed to eucalyptus vapor for about ten minutes (18). The vapor was administered using a 400 mg eucalyptus inhaler non-oral soft capsule made from Barij Essence Pharmaceutical Company that was poured in 250 mL of water in the thermal Beurer IH20 nebulizer that was given to the group through the venturi mask connected to nebulizer device. This was performed at 1 and 12 hours after extubation (11). The patients in the control group received no intervention. At time 0, 1, 6, 12 and 24 hours after extubation, the severity of cough was recorded in the two interventional and control groups. In this study, the mean and standard deviations summarized quantitative data, and the Chi-Square test compared qualitative variables. Generalized estimating equation(GEE) analysis with gamma link function was done the cough variable was not normal distribution. The GEE can be used for comparing trend in longitudinal study so we use it. Data were analyzed via SPSS version 20 software.

Results

Comparison of demographic and clinical variables of the subjects in the two groups showed no statistically significant difference between the two groups for sex (p = 0.31), age (P = 0.353), intubation duration(P = 0.128), laryngoscopy duration (P = 0.518), operation duration (P = 0.092), endotracheal tube cuff pressure (p = 0.233), Mallampati class (P = 0.229) and history of smoking(P = 0.509), see Table 1.

Comparison of the severity of cough at the times of immediate, 1, 6, 12 and 24 hours after extubation in the interventional and control groups with $x2$ test. Comparison of the severity of cough in the interventional and control groups in the immediate, 1,6,12 and 24 hours after extubation Showed that the severity of cough in the interventional group compared to control did not reduced (P > 0.05) (Table 2).

Based on generalized estimating equation with gamma conversion, risk of cough was Exp (β) = 9.5% in the control group compared with the interventional group in all times of immediate,1, 6,12 and 24 hours after extubation, which the difference was statistically significant (P = 0.004).

Table 1 Demographic and clinical characteristics of the subjects.

Variables \ Groups		Interventional	Control	*P*- value
Age		57.78 ± 5.38	56.24 ± 6.40	0.353
Gender	Male	22 (44%)	27 (54%)	0.31
	Female	28 (56%)	23 (46%)	
Intubation duration (min)		13.47 ± 0.43	13.54 ± 0.32	0.409
Laryngoscopy duration (second)		39.30 ± 7.96	40.46 ± 8.27	0.919
Operation duration (hour)		4.35 ± 0.33	4.29 ± 0.26	0.092
Endotracheal tube cuff pressure (Cm H2O)		16.92 ± 0.85	16.72 ± 0.94	0.202
History of smoking	Yes	16 (32%)	13 (26%)	0.509
	No	34 (68%)	37 (74%)	

Table 2 Comparison of severity frequency of cough at the times of immediate, 1, 6, 12 and 24 hours after extubation in the interventional and control groups (N=100).

Cough		No	Mild	Moderate	Severe	P value
0	Co*	7 (14%)	6 (12%)	32 (64%)	5 (10%)	$x^2 = 1.0$
	In**	5 (10%)	9 (18%)	30 (60%)	6 (12%)	P = 0.780
1	Co	8 (16%)	13 (26%)	26 (52%)	3 (6%)	$x^2 = 2.01$
	In	10 (20%)	18 (36%)	20 (40%)	2 (4%)	P = 0.57
6	Co	11 (22%)	17 (34%)	20 (40%)	2 (4%)	$x^2 = 2.17$
	In	14 (28%)	21 (42%)	14 (28%)	1 (2%)	P = 0.5
12	Co	14 (28%)	20 (40%)	15 (30%)	1 (2%)	$x^2 = 3.97$
	In	17 (34%)	25 (48%)	8 (18%)	-	P = 0.264
24	Co	16 (32%)	22 (44%)	12 (24%)	-	F = 4.97
	In	22 (44%)	24 (48%)	4 (8%)	-	P = 0.08

*Co = Control, **In = Interventional

Discussion

The eucalyptus vapor in this study could not significantly decrease the severity of cough. This research was done to aim assessment the effect eucalyptus vapor on cough.

The results of a study on the effects of 30 cc green tea gargle on cough after CABG surgery at the times of 1, 6, 12 and 24 hours after extubation revealed that the green tea mouthwash four times within 6 hours was only able to reduce coughing in 12 hours after extubation (9), which is incompatible with the present study. The green tea mouthwash in 12 hours after extubation has been effective in reducing cough.

Also, a study compared the effects of Betamethasone gel 0.05% and Lidocaine gel 2% on cough in patients undergoing elective surgery that lasted about 30 to 240 minutes at the times of 1, 6, 12 and 24 hours after extubation. The results indicated that Betamethasone gel significantly reduced the severity of cough compared to Lidocaine gel (5). Another study on the effects of inhaled Fluticasone on cough severity in women undergoing cesarean section under general anesthesia revealed that cough severity was reduced significantly with inhaled Fluticasone compared with controls (16). The results are indicative of the effect of corticosteroids on cough, contrary to the current study. On the other hand, intubation duration was much less in both mentioned study compared to the present study, and given that the intubation duration has a direct relationship with the coughing, the patients undergoing CABG suffered from cough more so than patients with short-term procedures, possibly due to the use of multiple catheters placed in the chest predisposes the patient to cough compared to cesarean section. Therefore, further studies are needed on the effects of higher doses and longer duration of eucalyptus vapor on cough.

However, more studies are necessary to examine effects of changing the dose and continuing duration of treatment with eucalyptus vapor over 24 hours after extubation in order to achieve anti-inflammatory properties comparable to topical corticosteroids. The peak impact of eucalyptus vapor after absorption from the respiratory system is 18 minutes and its action time is about 4 to 6 hours. The half-life of 1,8-Cineole eucalyptus is 104 minutes in the body (17- 19). According to previous studies, 200 mg eucalyptus intake three times daily had effective results during six months in patients with COPD and during three days in patients with asthma. Therefore, according to the peak effect and the dosage of eucalyptus in the above studies as well as frequency of cough 24 hours after extubation, it is recommended to administer eucalyptus vapor at

lower doses every 6 hours and continue for 24 hours after extubation in subsequent studies.

In general, it seems that the use of medicinal plants and similar studies are in their infancy, more studies are required to examine patients after surgery to improve knowledge in this field. This medicinal plant can use for redusing complications after extubation tracheal tube and it had positive effects in sore throat 6 and 12 hours after extubation. it is suggested to use it for other types of surgeries.

Some of the limitations of this study were factors related to individual differences that effect on the threshold of stimulation intensity for cough such as surgery stress (20), as well as personality different(21) in patients undergoing CABG surgery. The psychological factors can affect the perceived severity of cough, so they were out of control.

According to the approved anti-inflammatory properties of eucalyptus, it is suggested to conduct further studies on changes in dose or duration of treatment. So, most of the research conducted in this area was on the use of chemical anti-inflammatory drugs or topical anesthetics. Since the studies on herbal medicines can be helpful, so it is recommended to evaluate the effect of eucalyptus vapor on patients who are undergoing other surgical procedures.

Conclusion

The eucalyptus vapor in the current study could not significantly decrease the severity of cough.

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Conflict of Interest

No declare.

Author's Contribution

All authors contributed equally to the writing of the scientific proposal, data collection, and manuscript drafting. The final manuscript was reviewed and approved by all the authors.

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