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The Efficacy of Lavender Aromatherapy in Reducing Preoperative Anxiety in Ambulatory Surgery Patients Undergoing Procedures in General Otolaryngology

Michael Wotman, BA; Joshua Levinger, MD; Lillian Leung, PAC; Aron Kallush, BA; Elizabeth Mauer, MS; Ashutosh Kacker, MD

Background: Preoperative anxiety is a common problem in hospitals and other health care centers. This emotional state has been shown to negatively impact patient satisfaction and outcomes. Aromatherapy, the therapeutic use of essential oils extracted from aromatic plants, may offer a simple, low-risk and cost-effective method of managing preoperative anxiety. The purpose of this study was to evaluate the efficacy of lavender aromatherapy in reducing preoperative anxiety in ambulatory surgery patients undergoing procedures in general otolaryngology.

Methods: A prospective and controlled pilot study was conducted with 100 patients who were admitted to New York-Presbyterian/Weill Cornell Medical Center for ambulatory surgery from January of 2015 to August of 2015. The subjects were allocated to two groups; the experimental group received inhalation lavender aromatherapy in the preoperative waiting area while the control group received standard nursing care. Both groups reported their anxiety with a visual analog scale (VAS) upon arriving to the preoperative waiting area and upon departure to the operating room.

Results: According to a Welch's two sample t-test, the mean reduction in anxiety was statistically greater in the experimental group than the control group ($p = 0.001$).

Conclusion: Lavender aromatherapy reduced preoperative anxiety in ambulatory surgery patients. This effect was modest and possibly statistically significant. Future research is needed to confirm the clinical efficacy of lavender aromatherapy.

Key Words: Ambulatory surgical procedures, anti-anxiety agents, lavandula, otolaryngology, pilot projects.

Level of Evidence: 2b

INTRODUCTION

Preoperative anxiety is a common problem in hospitals and other health-care centers. Regardless of the severity of surgical intervention, patients may experience considerable apprehension from fear of the operation, anesthesia, and postoperative pain.[1] Preoperative anxiety has been shown to negatively impact patient satisfaction and outcomes. This emotional state is associated with increased use of narcotics and anesthetics, prolonged duration of hospitalization and postoperative wound healing, and reduced ability to fight infection and comprehend information about surgery.[2–4] Pharmacologic therapies, such as sedatives and opioids, are often used to treat preoperative anxiety. However, these medications have undesirable side effects, including fatigue, confusion, and restlessness.[5] Moreover, they can affect a patient's ability to actively participate in his or her postoperative care and delay hospital discharge.[6,7]

Aromatherapy, a form of complementary and alternative medicine (CAM), may offer a simple, low-risk and cost-effective method of reducing preoperative anxiety. The therapeutic use of essential oils extracted from aromatic plants to affect a person's mood and health, aromatherapy has a wide range of applications. It is fast-acting, noninvasive, has minimal side effects, and can be applied in multiple forms, including massage, inhalation, compress, and baths with mineral and herbal substances.[2] Aromatherapy was utilized in Egypt and India thousands of years ago as a remedy for different diseases, is now an established nursing practice in the United Kingdom, and has become increasingly popular in the United States.[3,8,9] The precise mechanism of aromatherapy is currently unclear; it is presumed to act both physiologically and psychologically. The process of inhalation aromatherapy begins when olfactory receptors are stimulated by volatile molecules. Depolarization of the primary olfactory neuron leads to generation of an action potential, which is propagated along the olfactory nerve axon to the olfactory bulb. From the olfactory

From the Department of Otolaryngology–Head and Neck Surgery, (M.W., J.L, L.L., A.K., A.Kacker); and the Department of Healthcare Policy and Research (E.M.), New York-Presbyterian/Weill Cornell Medical College, New York, New York, U.S.A.

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Send correspondence to Ashutosh Kacker, MD, 1305 York Avenue, 5th Floor. New York, NY 10021. Email: ask9001@med.cornell.edu

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bulb, axons of mitral cells enter the olfactory tract, which divides into medial and lateral olfactory striae. The lateral olfactory stria projects to the amygdala, a key structure of the limbic system involved in behavior and emotions.

Lavender is an important essential oil with a wide range of applications and few reported sensitivities. It is known for its sedative and relaxing effects. The precise mechanism by which lavender exerts its anxiolytic effects is uncertain. Two components of the lavender plant, linalool and linalyl acetate, have been shown to stimulate the parasympathetic nervous system. Linalyl acetate is recognized as a narcotic while linalool is known to act as a sedative.[10] Other reported mechanisms include interaction with NMDA or $GABA_A$ receptors, voltage-dependent sodium channels, voltage-dependent calcium channels, and glutamatergic and cholinergic neurotransmission.[11] Moreover, the anxiolytic efficacy of lavender aromatherapy has been assessed in numerous clinical settings. Lavender aromatherapy was shown to reduce anxiety in patients in the coronary intensive care unit (ICU),[10] dental office,[12,13] before open-heart surgery,[8] general surgery,[1] intrauterine device (IUD) insertion,[9] during peripheral venous cannulation,[14] and after myocardial infarction[5] and percutaneous coronary intervention.[15] On the other hand, lavender therapy had no significant effect on anxiety in patients undergoing radiotherapy,[16] colonoscopy,[17] and after coronary artery bypass surgery.[2] In one study, lavender and unscented aromatherapy both decreased anxiety and improved sense of well-being before breast surgery.[18] The authors attributed their findings to a placebo effect related to added attention given to patients. The discrepancies in the literature may also be attributable to variations in study design, such as differences in dosage, duration, method of application, and specie of lavender, as well as different levels of anxiety experienced by patients in different clinical settings. Moreover, there is a paucity of literature pertaining to the use of lavender aromatherapy in the ambulatory surgery setting, in which preoperative waiting time is brief and a convenient method of reducing anxiety is needed. In light of these findings, it was decided to conduct this pilot study to investigate the efficacy of lavender aromatherapy in reducing preoperative anxiety in ambulatory surgery patients undergoing procedures in general otolaryngology.

MATERIALS AND METHODS

Study Design and Participants

A prospective and controlled pilot study was conducted with 100 patients who were admitted to New York-Presbyterian/Weill Cornell Medical Center for ambulatory surgery from January of 2015 to August of 2015. Inclusion criteria included patients over the age of 18 years, able to communicate with the researchers, and agreeable to receiving aromatherapy before surgery. These subjects planned to undergo a general otolaryngology outpatient procedure, such as septoplasty, inferior turbinate reduction, tonsillectomy, functional endoscopic sinus surgery, and sialoendoscopy. The study was limited to this subset of patients for convenience and to minimize variation in preoperative anxiety. Those who were allergic to lavender or diagnosed with a mental illness were excluded from the study. Importantly, patients with an impaired sense of smell were not excluded from the study. The Institutional Review Board (IRB) of Weill Cornell Medical College approved the entire study process.

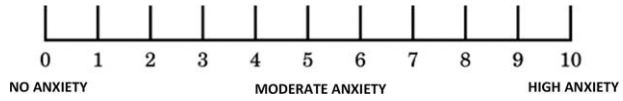

Fig. 1. Visual Analog Scale.

Procedure

A convenience sampling method was used to select and enroll patients for the study. Subjects were recruited from the patient groups of two attending physicians in the Department of Otolaryngology at Weill Cornell Medical College. Before the start of the study, an attending otolaryngologist had already been providing aromatherapy to patients. Therefore, subjects for the experimental arm were selected from his patient group. The subjects of the control group were selected from the patient group of a second physician who also performed procedures in general otolaryngology but did not provide patients with aromatherapy. An amendment was added to this procedure during the course of the study. After a sufficient number of patients were enrolled in the experimental group, participants for the control arm were selected from both patient groups. Upon arrival to the preoperative waiting area, the aims and methods of the study were explained to patients who met the inclusion criteria. Consent was obtained in writing and subjects were assured of data confidentiality. Both arms of the study completed a two-part questionnaire. The first part was given after consent was obtained and included a visual analog scale (Fig. 1) from 0–10 to measure anxiety level and a check box for whether patients had been wearing cologne or perfume. Those in the experimental group were then given a lavender AromaTab and instructed to open the patch on the minimum scent, remove the adhesive back, and place the tab over the gown in the abdominal region. Those in the control group were not given aromatherapy, but rather received standard nursing care, which involves the routine preoperative care provided to patients by the nursing and anesthesia staff, including provision of preoperative medications, such as anxiolytics.

Shortly before departure to the operating room, a second survey with a visual analog scale was given to both groups. The experimental group answered three additional questions related to their experience. They were asked if they felt calmer with the aromatherapy, if they found the lavender scent pleasant, and if they used aromatherapy on a regular basis. The participants in the experimental group received aromatherapy for a minimum of 30 minutes.

Instruments

Lavender essential oil was chosen for its calming and relaxing effects. Lavender-sandalwood AromaTabs, scented tabs on a self-adhesive level with 100% pure essential oils, were used to administer the aromatherapy. This method is a simple, controlled and consistent delivery system. With a dual-notched protective plastic covering, patients can choose a minimum or maximum scent exposure based on personal preference. Further, a visual analog scale was used to evaluate each participant's anxiety upon arrival to the preoperative area and before departure to the operating room. This tool provides a clear

TABLE I.
Characteristics of Control and Treatment Groups.

	Control N (%) or Mean (SD)	Treatment N (%) or Mean (SD)	Test Statistic (df)*	*P*
Sex	22 (44.00%)	26 (52.00%)	0.361 (1)	0.548
Female				
Male	28 (56.00%)	24 (48.00%)		
Age (years)	40.30 (14.38)	43.28 (15.15)	−1.009 (97.732)	0.316
Height (m)	1.72 (0.10)	1.72 (0.10)	−0.221 (97.816)	0.825
Weight (lbs)	167.82 (42.13)	167.60 (36.28)	0.028 (95.883)	0.977

Pearson's Chi-Squared or Welch's two sample t-tests, as appropriate
*Test Statistic is Chi-Square or t, as appropriate

understanding of the patient's anxiety level as subjects self-ascribe their level of anxiety on a 10-cm horizontal line between 0 and 10 that is anchored by verbal descriptions of no, moderate, and high anxiety. A higher score indicates a greater level of anxiety.

Data Analysis

Demographic characteristics and anxiety scores upon arrival were described as N (%) or mean, median, and spread and compared between the treatment and control groups by Pearson's Chi-Squared test or Welch's two-sample t-test, as appropriate. To control for differences in arrival anxiety scores between the two groups, an anxiety change score was calculated as the departure anxiety score minus the arrival anxiety score. Welch's two sample t-test was again employed to assess differences in anxiety change between the two groups. Lastly, responses to aromatherapy questions within the treatment group were described as N (%) and respective 95% confidence intervals were calculated to assess the precision of the obtained estimates. All analyses were performed in R version 3.3.2 (Vienna, Austria). All *p*-values were two-sided with statistical significance evaluated at the 0.05 alpha level.

RESULTS

Many patients were prescreened, but of those approached, 115 subjects were enrolled in the study. Of the 115 patients enrolled, 15 patients withdrew or were removed from the study. Insufficient exposure to aromatherapy was the primary reason for removal from the study. This was attributable to early transport to the operating room. One patient removed the AromaTab after experiencing nausea.

The statistical analysis was performed with 100 patients. There were 50 patients in each arm of the study. Patient characteristics, including age, sex, height, and weight, did not differ significantly between the experimental and control groups (Table I). There were 22 females and 28 males in the control group; the mean age of the subjects was 40.3 years. In the experimental group, there were 26 females and 24 males; the mean age was 43.28 years. Finally, in the control group, there were two individuals with documented anxiety disorders and three individuals with documented anxiolytic medications. There were two individuals with documented anxiety disorders and nine individuals with documented anxiolytic medications in the experimental group.

Patient anxiety was recorded upon arrival to the preoperative waiting area and before departure to the operating room (Table II). The mean arrival anxiety was 3.79 in the control group and 4.74 in the experimental group. The mean departure anxiety was 3.78 in the

TABLE II.
Anxiety Scores of Control and Treatment Groups.

				Arrival Anxiety				
	N	Mean	SD	Median	Min	Max	Test Statistic (df)*	P
Control	50	3.79	2.35	4.00	0.00	10.00	−2.085 (97.603)	0.040
Treatment	50	4.74	2.20	5.00	0.00	10.00		
				Departure Anxiety				
	N	**Mean**	**SD**	**Median**	**Min**	**Max**	**Test Statistic (df)**	***P***
Control	50	3.78	2.33	4.00	0.00	10.00	0.248 (96.875)	0.804
Treatment	50	3.67	2.09	4.00	0.00	9.00		
				Anxiety Change (Departure - Arrival)				
	N	**Mean**	**SD**	**Median**	**Min**	**Max**	**Test Statistic (df)**	***P***
Control	50	−0.01	1.29	0.00	−4.00	4.00	3.294 (86.993)	0.001
Treatment	50	−1.07	1.87	−1.00	−4.00	5.00		

Welch's two sample t-tests
*Test Statistic is t

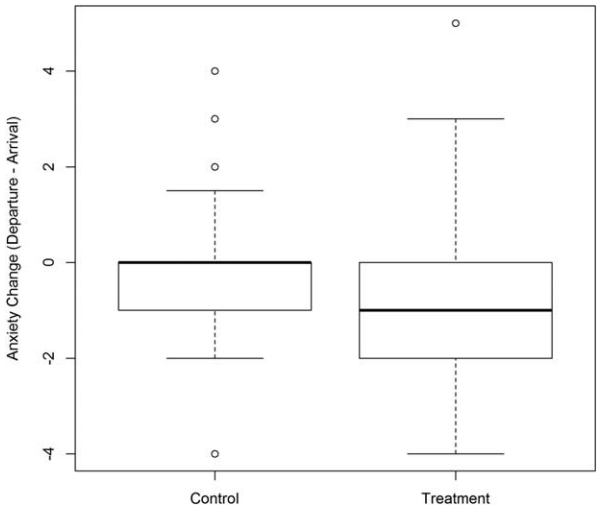

Fig. 2. Change in Anxiety in Control and Treatment Groups.

control group and 3.67 in the experimental group. Moreover, the mean change in anxiety was calculated for both arms of the study (Fig. 2). Anxiety in the control group decreased on average by 0.01 while anxiety in the experiment group decreased on average by 1.07. According to a Welch's two sample t-test, the mean reduction in anxiety was statistically greater in the experimental group than the control group ($p = 0.001$). The participants that received aromatherapy answered three additional questions related to their experience (Table III). A majority of the subjects reported that they felt calmer with the intervention (77.08%) and found the lavender scent pleasant (92.0%). Most patients (86%) did not use aromatherapy on a regular basis.

DISCUSSION

Preoperative anxiety is a common problem in hospitals and other health care settings. This emotional state is associated with adverse patient outcomes and satisfaction. Aromatherapy may offer a simple, low-risk, and cost-effective method of reducing preoperative anxiety. Therefore, a controlled pilot study was conducted to assess the efficacy of lavender aromatherapy in reducing preoperative anxiety in ambulatory surgery patients undergoing procedures in general otolaryngology. The results of the study indicate that lavender aromatherapy resulted in a statistically significant reduction in preoperative anxiety as measured by the subjects with a visual analog scale. This is consistent with a significant number of publications that have illustrated the anxiolytic effects of lavender aromatherapy in different clinical settings.

In retrospect, the clinical significance of this reduction in anxiety is questionable as the mean anxiety in the experimental group only decreased by a value of 1.07. Moreover, there are several important limitations of this study. Firstly, the experimental and control groups were non-blinded, allowing for the possibility of a placebo effect to have influenced the results. The use of standard nursing care as the control precluded from effective blinding. In future studies, an unscented placebo or alternative essential oil may be used as a more effective control. However, the use of an unscented placebo may interfere with blinding while an alternative scent may not serve as a true placebo. Secondly, a convenience sampling method was utilized in this study. This method of sampling is subject to selection bias and may limit the generalizability of the results. A larger study utilizing a random sampling method should be used in further investigations.

The statistical analysis was limited by a lack of control for any confounding factors, such as preoperative use of pharmacologic anxiolytics, prior surgical experience, and differing surgical procedures, which may have caused patients to experience different levels of preoperative anxiety. Of important note, the difference in preoperative anxiety between the control and experimental groups was statistically significant ($p = 0.04$). The experimental group demonstrated higher preoperative anxiety scores. A review of the preoperative evaluations and operative reports revealed that both groups had the same number of individuals with documented anxiety disorders while the experimental group had more patients using anxiolytic medications, suggesting that these two factors did not contribute significantly to the difference in preoperative anxiety. Since all patients underwent ambulatory procedures in general otolaryngology, with many patients undergoing either functional endoscopic sinus surgery, septoplasty/turbinate reduction, sialoendoscopy, or tonsillectomy, the differing surgeries between the two groups most likely did not contribute greatly to the difference in preoperative anxiety. Nevertheless, the experimental group did demonstrate higher anxiety scores initially and it is therefore expected that the experimental group anxiety scores would trend closer to the average on the second measurement, regardless of treatment. Given the questionable clinical significance and limitations of this study, further research is needed to substantiate the clinical benefits of lavender aromatherapy in the ambulatory surgery setting, especially its efficacy in reducing adverse patient outcomes, limiting use of preoperative

TABLE III.
Experimental Group Questionnaire.

Did the patient feel calmer with aromatherapy?	N (%)	95% CI
No	11 (22.92%)	13.31–36.54%
Yes	37 (77.08%)	63.46–86.69%
missing	2	
Did the patient find the lavender scent pleasant?		
No	4 (8.00%)	3.15–18.84%
Yes	46 (92.00%)	81.16–96.85%
Does the patient use aromatherapy on a regular basis?		
No	43 (86.00%)	73.81–93.05%
Yes	7 (14.00%)	6.95–26.19%

anxiolytic medications, and improving patient satisfaction. However, it should be noted that a majority of patients reported that they felt calmer while receiving aromatherapy and found the lavender scent pleasant. Given the simplicity, low cost, and safe profile of lavender aromatherapy, the authors promote its use in reducing preoperative anxiety in the ambulatory surgery setting.

CONCLUSION

Given the adverse effects of preoperative anxiety and the simplicity of aromatherapy, health care providers should consider the use of preoperative lavender aromatherapy in the ambulatory surgery setting, in which a short preoperative waiting time necessitates a convenient method of anxiety reduction. In this study, lavender aromatherapy reduced preoperative anxiety in ambulatory surgery patients undergoing procedures in general otolaryngology. This effect was modest and possibly statistically significant. The study has several important limitations as well. Future research is needed to confirm the clinical efficacy of lavender aromatherapy.

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