

Essential Oils to Reduce Postoperative Nausea and Vomiting

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Purpose: *The purpose of this study was to determine if using essential oil products for adult patients reduced the need for antiemetics for postoperative nausea and vomiting (PONV).*

Design: *A prospective and retrospective cross-sectional design using a convenience sample.*

Methods: *Double blinded to the type of essential oil, subjects randomly selected a nasal inhaler containing peppermint, ginger, or a combination of both. A prophylactic dose was given preoperatively, and during the postoperative period nausea was assessed using verbal descriptive scale.*

Findings: *Overall 322 same day surgical patients were analyzed (control group [n = 179] and intervention group [n = 143]). The intervention group had a greater history of PONV but received fewer doses of antiemetics postoperatively compared with the control group. There was no significant difference in the effectiveness of the three types of inhalers.*

Conclusions: *Aromatherapy demonstrated a statistically significant ($P < .05$) reduction in the need for antiemetics to treat PONV.*

Keywords: *aromatherapy, postoperative nausea, hospital, surgical center.*

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Conflict of interest: Maxine A. Fearrington has an apparent conflict of interest which may question the objectivity of the research because she is an independent consultant to the industry selling essential oils, the intervention for this protocol. However, for this protocol, the intervention product comes from a company she has no association with. Brandon W. Qualls and Mary G. Carey have no conflicts of interest.

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PATIENTS ANTICIPATING SURGERY typically experience some degree of anxiety related to the potential for experiencing unpleasant side effects such as postoperative nausea and vomiting (PONV). Traditional interventions to treat PONV involve administering intravenous (IV) antiemetics. However, pharmacologic therapies can be accompanied by adverse consequences including sedation, alterations in heart rate or rhythm, decreased level of consciousness, and an increased demand on nursing care.¹⁻³ Aromatherapy offers an alternative or complimentary therapy that can be either nurse or patient administered.

Literature Review

Currently, aromatherapy is used in a variety of clinical settings and for a variety of purposes. Also referred to as essential oils, aromatherapy is most frequently used to manage nausea,¹⁻¹⁰

pain,⁶ insomnia,⁶ and stress or anxiety.^{11,12} Essential oils are concentrated essence extracted from plants using a distillation process.¹³ Reis and Jones caution that not all essential oils are created equally; consumers (nurses) should purchase and use oils that meet the criteria for therapeutic or medicinal quality. Many oils may be certified pure and organic, which means they may meet established guidelines, yet the therapeutic effect may be in question.¹³ When the right oils are used for the right reason, and in the right way, many beneficial outcomes can be realized.

One example of a beneficial use of aromatherapy is to reduce anxiety. Stress and anxiety are often present in many hospitalized patients and can lead to undesirable outcomes. Bikmoradi et al studied the effects of inhaled lavender essential oils on the vital signs of 60 patients undergoing coronary bypass surgery.¹¹ This study examined changes in mental stress using both a Depression Anxiety Stress Scale (DASS-21) questionnaire and changes in vital signs. The results were not statistically significant for the intervention group, except for an increase in systolic blood pressure at 5 and 30 minutes postintervention. At the 5-minute mark on the third day postprocedure, systolic blood pressure for the control group (114 ± 20) was lower than the intervention group (127 ± 25), and at the 30-minute mark, similar results were noted (116 ± 22 and 131 ± 25 , respectively). Despite the lack of positive evidence, Bikmoradi et al¹¹ recommended lavender as a low cost, minimal risk intervention for use that may help in decreasing anxiety and mental stress. These contradictory results demonstrate the need for further studies in this area.

Another study examined women undergoing breast biopsies ($n = 87$) and the effects of aromatherapy on anxiety levels. Trambert et al¹² compared lavender-sandalwood and orange-peppermint essential oils against a placebo, which revealed statistically significant results for women in the lavender-sandalwood blend group at reducing anxiety. This study was a randomized three-arm study measuring anxiety levels using the State-Trait Anxiety Inventory, with the lavender-sandalwood group being both statistically and clinically significant in the reduction of postprocedure anxiety.

Johnson et al⁶ reported on a retrospective study ($n = 5,837$) where nurses in a large health system

in the mid-west were trained in the use of various essential oils for use as “therapeutic interventions” as deemed appropriate by the nurses. Symptoms such as pain, anxiety, and nausea were addressed using essential oils of sweet marjoram, lavender, mandarin, and ginger, respectively. This study of nurse-delivered aromatherapy revealed a decrease in score among the three outcomes; however, pain scores decreased an average of three points on a 0 to 10 scale, which demonstrated strong evidence (statistically significant, yet the actual results were not provided) to support the use of essential oils as a complement to standard of care in a holistic patient care environment.⁶

PONV is a relatively common side effect of surgery; yet the exact causation is not fully understood.³ A number of factors have been identified that can lead to an increased incidence of PONV, such as female gender, nonsmoker, a history of PONV or motion sickness, and surgical procedures lasting greater than 1 hour.³ Several studies have been conducted using peppermint, ginger, or various other combinations for use as prevention or treatment of PONV.¹⁻¹⁰ Two systematic reviews were published in 2012 examining the use of various types of inhaled aromatherapy for PONV,^{14,15} demonstrating encouraging but not yet convincing results. However, most of the studies reviewed were small or lacking in rigor. Since 2012, several larger and more compelling studies have been conducted. Three of the four studies that tested the use of peppermint oil demonstrated positive results in reducing PONV.^{1,2,7,10} Similarly, three other studies using inhaled ginger oil^{4,6,8} and three using a commercially prepared product QueaseEASE^{3,9} or a combination of several oils⁵ also showed favorable results in reducing PONV. Despite these findings, many practitioners still hesitate to embrace this treatment modality, likely because of the need for additional research that is more rigorous in design,^{7,8} a larger sample size,^{2,3} or longer in duration.^{1,10}

Purpose

The purpose of this study was to determine if aromatherapy (peppermint, ginger, or a combination) for adult hospital ambulatory or 23-hour surgical patients would reduce the need for antiemetics to treat PONV.

Sample and Setting

The study took place in the surgical center of a large urban teaching hospital. The target population was adult patients scheduled for same day or short-stay surgical procedures. The intervention group was a convenience sample, selected from the operating room schedule that met the initial criteria of being scheduled for ambulatory surgery or a 23-hour stay. Most (94.4%) of surgical procedures targeted patients in six services including orthopaedics, urology, general and trauma, plastics, neurosurgery, and ear, nose, and throat, with less than 6% being colorectal and gynecologic surgeries. They were then screened using the inclusion criteria of being at least aged 18 years, able to understand and follow directions, able to give informed consent, and understand, read, and write English. Patients were excluded if they had a history of chronic obstructive pulmonary disease, asthma, or other respiratory disorder that could be exacerbated by strong odors, inability to smell fragrances (before or after surgery), allergic or sensitive to either peppermint or ginger, or sensitive to any strong odors. The control group was a retrospective chart review of prior year's surgeries that met the same initial inclusion criteria (same-day or 23-hour stay) as the intervention group.

Protection of Human Subjects

After receiving Institutional Review Board approval and registering as a Phase II trial on clinicaltrials.gov, recruitment of subjects began. All data were recorded on an encrypted portable device, and none of the stored data contained any identifiable information about the research subjects. Paper copies were stored in a secure location, and once all pertinent data were captured, the papers were shredded.

Methods

For the retrospective chart review, initial selection of patients was accomplished by the first author by reviewing retained hard copies of operating room schedules from July through December 2017, of patients who had ambulatory surgery or stayed in the 23-hour unit postoperatively. Once identified, the patients' electronic medical records were accessed using a unit-based computer. Data collected included age, gender, race, type of surgery, length

of stay, history and episodes of PONV, and type and number of both intraoperative and postoperative doses of antiemetics administered. These patients comprised the control group as they received the standard IV antiemetic medication for any PONV.

Intervention: Essential Oils

The inhalers were premade by designated personnel (not associated with the surgical center patients) and contained four drops of essential oils of peppermint or ginger, or a combination containing two drops of each of the two oils. The inhalers were sealed in plastic shrink-wrap and marked with a four-digit number, which was recorded on a log and held in a separate secure location in the surgical center until the study was complete (Figure 1). The inhalers all looked the same and the fragrance was undetectable; therefore, the study was double blinded to the type of essential oil.

For the prospective study, all providers and nurses in the postanesthesia care unit and surgical center were provided training and material to inform them of the study protocol. Potential subjects were identified from the operating room schedule as meeting the initial criteria. These subjects were then approached to determine initial interest in study participation. Subjects were then given an information sheet, and the study protocol explained. Investigators offered the subjects the informed consent to read, ask questions, and sign if participation was desired. Consent forms were placed in a secure location in the surgical center.



Figure 1. Plastic nasal inhaler sealed in plastic with unique four-digit number. This image is available in color online at www.jopan.org.

After obtaining informed consent, a color-coded (blue) wristband was applied to the subject's wrist as a visual aid that designated the patient as a study subject. Several blue dot stickers were also applied to various locations in the paper chart that accompanied the subject throughout their hospital stay as another way to flag the patient as a study subject. All data were deidentified, and the following variables were collected: age, gender, race, type of surgery, length of stay, history and episodes of PONV, and type and number of doses of antiemetics administered. The numeric number from the blue wristband served as the subject's unique identifier and was in no way tied to the patient's medical record. The subject then selected at random a nasal inhaler from a basket. The subjects were instructed to use the inhaler for one dose (two to three slow deep inhalations from the nasal inhaler) before receiving any sedating medication preoperatively. The inhaler was then placed inside the patient's paper chart, which accompanied the patient throughout their stay in the hospital.

The nurses in the postanesthesia care unit were trained to assess nausea with every set of vital signs, using a 0 to 3 verbal descriptive scale,⁵ and for any score of 1 to 3, offer the subject the nasal inhaler as the first intervention. Nausea was then reassessed 5 minutes after inhaler was used, and if nausea was not yet relieved, the subject would be offered a second dose from the inhaler. The subjects were advised that they could, at any time, request a dose of ordered medication with or in place of the nasal inhaler without being unenrolled in the study. Any patient who was actively vomiting was given a dose of ordered medication without using the inhaler; however, any subsequent episodes of nausea were encouraged to use the nasal inhaler before receiving additional medication.

Analysis Plan

All analyses were conducted using Statistical Package for the Social Science (SPSS v25 for Windows) and statistical significance was set to $P < .05$. Continuous measures (eg, age) were reported as mean \pm standard deviation and categorical variables (eg, gender) as a count (n, %). Demographic and clinical characteristics of the groups (ie, control vs intervention) were compared using Student's t test to determine if

there were differences between the groups. Statistical significance was set at $P < .05$. Model 1 used a repeated measures analysis to compare changes in nausea score preintervention and postintervention. Model 2 examined total length of stay in relation to inhaler fragrance and intraoperative medications. Unadjusted analysis of variance was also conducted to determine any changes in preoperative and postoperative nausea assessment scores between the three intervention arms. A power analysis was conducting using $\alpha = 0.05$ and $\beta = 0.20$ determined a sample size of 190 was needed; therefore this study was adequately powered.

Results

Overall 322 same day surgical patients were analyzed (control group [n = 179] and intervention group [n = 143]). Among the eight hospital adult services, most patients (70%) came from three services including urology, neurosurgery, and general or trauma.

Among the six variables (age, gender, race, episodes of PONV, total hours in the operating room, and average number of doses of antiemetics administered) all were statically different between the control and the intervention groups, except age and gender. It should be noted that subjects in the intervention group were predominantly White, had a greater history of PONV, and received fewer doses of antiemetics postoperatively (Table 1). Those who used an antiemetic and those who had a history of postoperative nausea had greater preimprovement to postimprovement in nausea scores after controlling for the other variables in the model. This model accounted for 20% of the variance in nausea change scores (Table 2). Those who spent 2 hours or greater in the operating room had longer length of stay in the surgical center compared with those less than 2 hours after controlling for the other variables in the model. This model accounted for 13% of the variance in length of stay (Table 3).

Within the intervention group (~45% of total sample), the three types of essential oils included peppermint, ginger, and a combination of both, the distribution was 16%, 17%, and 12%, respectively, whereas the control group constituted ~55% of the total sample. There was no

Table 1. Control Versus Intervention for Essential Oils to Reduce PONV (n = 322)

	Control (n = 179)	Intervention (n = 143)	P Value
Age $\bar{x} \pm SD$	55.18 \pm 17.53	54.64 \pm 15.89	.774
Sex	Female = 87 (48.6%) Male = 92 (51.4%)	Female = 71 (49.7%) Male = 72 (50.3%)	.85
Race (% , n)	Caucasian = 76.5% (137) African American = 15.1% (27) Hispanic/Latino = 6.1% (11) Other = 2.2% (4)	Caucasian = 90.9% (130) African American = 6.3% (9) Hispanic/Latino = 0.7% (1) Other = 2.1% (3)	.002
History PONV	Yes = 4.5% (8) No = 95.5% (171)	Yes = 14.0% (20) No = 86.0% (123)	.003
Number of PONV episodes per patient $\bar{x} \pm SD$	0.54 \pm 0.90	1.72 \pm 1.80	< .001
Number of doses of antiemetics per patient $\bar{x} \pm SD$	0.53 \pm 0.85	0.15 \pm 0.47	< .001

PONV, postoperative nausea and vomiting.

statistically significant difference in the type of inhaler used ($P = .62$). A separate unadjusted analysis of variance produced similar results, supporting the previous findings. During the study, no complications or adverse reactions occurred.

Although anecdotal information was not systematically collected or studied, comments from the nurses included "...patients were happy with their inhaler..." "...wouldn't give me the inhaler back, but promised to tell me when it was used..." and "I'm certain I gave fewer doses of intravenous antiemetics during the study period." In addition, on more than one occasion, patients' comments included "I love my inhaler," "can I do this again next time I have surgery?," and "I want my (eg, child, niece, husband) to try this for their car sickness." One study participant commented "I don't

like the smell, but it seemed to work anyway." Also, several patients that either declined to participate in the study or were never approached requested to use a nasal inhaler when they experienced PONV, and the IV antiemetics were unsuccessful in relieving their symptoms. In all cases, those patients experienced decreased symptoms and expressed satisfaction with the nasal inhaler. None of those patients were included in the study data.

Discussion

This nurse-led study demonstrated that patients who receive aromatherapy postoperatively for nausea have fewer antiemetics in the adult hospital ambulatory or 23-hour surgical patient as compared with the control group; in addition,

Table 2. Repeated Measures Analysis—Changes in Nausea (VDS) Scale

Variable	B (SE)	t Value	P Value	95% CI Lower	95% CI Upper
Age	0.001 (0.01)	0.12	.90	-0.02	0.02
Sex	0.13 (0.36)	0.38	.71	-0.55	0.80
Race	0.19 (0.83)	0.23	.82	-1.47	1.85
Total number of hours OR	-0.34 (0.28)	-1.23	.22	-0.90	0.22
Number of intraoperative medicines	-0.39 (0.25)	-1.56	.13	-0.90	0.11
History of PONV	0.77 (0.38)	2.05	.05	0.02	1.53
Type of inhaler	-0.10 (0.20)	-0.50	.62	-0.50	0.30
Antiemetic used	1.25 (0.60)	2.08	.04	0.05	2.45
Inhaler \times antiemetic	-0.34 (0.33)	-1.05	.30	-0.99	0.31

CI, confidence interval; OR, operating room; PONV, postoperative nausea and vomiting; VDS, verbal descriptive scale.

Model: $R^2 = 0.20$, $F = 1.54$, $P = .16$.

Table 3. Length of Stay Comparison

Variable	B (SE)	t value	P Value	95% CI Lower	95% CI Upper
Sex	2.09 (2.83)	0.74	.46	-3.58	7.77
Ethnicity	2.42 (7.00)	0.35	.73	-11.60	16.45
Age	0.06 (0.08)	0.79	.43	-0.10	0.23
Total number of hours in OR	4.48 (2.36)	1.90	.06	-0.24	9.20
Number of intraoperative medicines	2.98 (2.13)	1.40	.17	-1.29	7.25
History of PONV	0.96 (3.19)	0.30	.77	-5.44	7.35
Type of inhaler	0.74 (1.70)	0.44	.66	-2.67	4.16
Antiemetic used	-2.76 (5.07)	-0.54	.59	-12.91	7.40
Inhaler × antiemetic	1.47 (2.75)	0.54	.59	-4.03	6.98

CI, confidence interval; OR, operating room; PONV, postoperative nausea and vomiting.

Model: $R^2 = 0.13$, $F = 0.93$, $P = .51$.

all three arms (peppermint, ginger, and a combination) demonstrated a reduction in the need for antiemetics. Among the three types of essential oils, they were evenly distributed indicating that the randomization of the inhalers was effective.

The rate for PONV in this study was approximately 27%, which is consistent with national rates, which is approximately 30%.¹⁶ Thus, it is recommended to use a simplified risk score for PONV created by Apfel et al,¹⁷ which evaluates adults preoperatively, so that preventive strategies like essential oils can be offered to high-risk patients. The components of the simplified risk score include the following four highly predictive risk factors: female gender, nonsmoker, history of PONV, and expected administration of postoperative opioids. On the basis of the number of risk factors present, 0, 1, 2, 3, and 4, the corresponding risk of PONV is 10%, 20%, 40%, 60%, and 80%, respectively.

PONV continues to plague many postoperative patients, with traditional IV medication not always a reliable option. Aromatherapy has shown success as an adjunct therapy for managing PONV symptoms. QueaseEASE is highly promoted in perianesthesia literature; however, it is at a much higher price-point than the inhalers used in this study. The inhalers used in this study were an inexpensive alternative, albeit, required a trained nurse to prepare them for patient use.

Strengths and Limitations

This study was a prospective, double-blind randomized clinical trial that was designed and

implemented by nurses. Neither the subjects nor investigators knew which of the three-arm intervention was to be used until the subject selected the nasal inhaler. The low cost of the inhalers and essential oils was also the strength of the study, with the net cost being approximately \$0.50 each, and the subjects could take it home with them. In fact, hospital pharmacies may be able to manufacture the inhalers at even lower costs. This study was nurse-led and developed and was supported by the Department of Anesthesia as well as the hospital-based Nursing Practice Research Internship.

Limitations in the research design included using a convenience sample and a retrospective chart review for the control group rather than a placebo, as well as variability within nursing practice. Nausea is routinely assessed in the postoperative patient population; however, the measurement tool used in this study was new, and therefore there was a certain learning curve associated with it. There were also inequities between the two groups, for example race. Because the control group had no exclusion criteria, as long as they met the inclusion criteria of being a same day or 23-hour stay patient, non-English speaking patients were included in the control group. Also, it was not always well documented in the electronic medical record when patients had a history of PONV, which may have led to an inequality between groups. Although the number and type of intraoperative antiemetics were collected and controlled for, the type of anesthesia agent was not addressed in the analysis plan. Finally, selection of patients based on surgical type and postoperative assignment (same day or 23-hour

stay) excluded many individuals who may have benefited from the intervention.

Future Studies

Further studies should be conducted to expand the patient population to include those surgical patients that are admitted to the hospital. Use of a placebo group would strengthen the study design; however, using an inhaler without any fragrance would alert the subject and may cause increased patient anxiety. However, use of a placebo with a scent that is not an essential oil (such as lemon juice) could prove to be more effective in forthcoming study development. It may also be beneficial to allow the nasal inhalers to be patient-controlled, and rather than assessing the nausea score preintervention and postintervention, simply document the number of doses of antiemetics administered. In addition, understanding nurses, patients, and families' satisfaction

with nonpharmacologic interventions would contribute to the literature.

Conclusions

When properly prepared and using the correct essential oil(s), aromatherapy should be considered for most of adult postoperative patients. It is cost effective, reduces the need for nursing time and costly, often sedating, medications, and increases patient satisfaction.

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