Inhaled peppermint oil for postop nausea in patients undergoing cardiac surgery

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Abstract

Background. Postoperative nausea is a common occurrence that is very uncomfortable for patients and may result in complications including pain, strain at the surgical site, aspiration, and possible dehiscence. Antiemetics used to manage the nausea cause many adverse reactions, such as dysrhythmias and/or drowsiness resulting in an unwillingness to ambulate or perform deep-breathing exercises. **Literature review**. Previous studies have reported a decrease in nausea following the use of peppermint oil. **Study methodology**. Researchers obtained informed consent from 123 patients for this study; 34 (28%) of them experienced nausea and were offered a nasal inhaler that contained peppermint oil. **Results.** The average nausea rating before the use of peppermint oil was 3.29 (SD, 1.0) on a scale of 0 to 5, with 5 being the greatest nausea. Two minutes later, the average nausea rating was 1.44 (SD, 1.3). Using paired t-tests, these differences were found to be statistically significant ($P = 0.000$). **Discussion.** The researchers concluded that peppermint oil inhalation is a viable first-line treatment for nausea in postoperative cardiac surgery patients.

POSTOPERATIVE nausea and vomiting (PONV) is a common complication, especially after surgeries requiring general anesthesia.[1] For postoperative cardiac surgery patients, vomiting can place strain on the surgical site, causing pain and sometimes dehiscence. PONV can cause alterations in normal fluid and electrolyte balance including hypovolemia and hypokalemia, prolong postoperative stays, and increase healthcare costs.[2-4] PONV is the most common complication in the postanesthesia care unit, with reported incidences of 10% to 30%.[1]

Antiemetics are the first line of defense against PONV, but they are not always effective, can be expensive, and may cause adverse reactions, including drowsiness and dysrhythmias.[5]

This research study evaluates the use of peppermint oil aromatherapy to manage PONV in cardiac surgery patients. Aromatherapy includes the inhalation of fragrances such as peppermint to provide benefits such as the relief of nausea. The participants were offered a peppermint oil inhaler as an alternative therapy for nausea.

Background

According to the Evidence-based Clinical Practice Guideline for the Prevention and/or Management of Postoperative Nausea and Vomiting (PONV) of the American Society of PeriAnesthesia Nurses (ASPAN), the incidence of PONV is as high as 70% to 80% for high-risk patients.[5] Risk factors include female gender, nonsmokers, long surgeries, and a history of motion sickness or PONV. The more risk factors, the greater the risk. PONV is patients' most commonly reported concern before elective surgery and is considered "more debilitating than postoperative pain."[6]

PONV can cause dehydration, electrolyte imbalances, aspiration, airway compromise, suture tension, esophageal tears, dehiscence, venous hypertension, bleeding, and increased intracranial pressure.[3] These complications may result in longer hospital stays, increasing costs significantly.[7] Nausea and vomiting can have psychological effects, such as discomfort, embarrassment, exhaustion, dissatisfaction, and fear of further surgeries.[7]

Prescribers choose antiemetics based on cost, preference, patients' adverse drug reactions, patient outcomes, and current evidence.[3] Effectiveness varies according to the absorption, distribution, metabolism, and excretion of anesthetic agents.

The antiemetic of choice in the cardiovascular critical care complex (CVCCC) in the researchers' institution is ondansetron, a selective serotonin-receptor (5-HT3) antagonist that prevents activation of the chemoreceptor trigger zone. However, it is not always effective in relieving nausea. The most common adverse reaction is drowsiness, which interferes with patients' ability and willingness to cough, deep breathe, and mobilize.[8] Reluctance to cough and deep breathe can increase supplemental oxygen requirements and the risk of pneumonia. Failure to mobilize can result in ileus.[9] Ondansetron can also prolong the QT interval, which can lead to dysrhythmias, including bradycardia and ventricular tachycardia.[5] Many cardiac surgery patients are already using other medications that lower their heart rate or increase the risk of QT prolongation.

Many patients in the clinical setting seek alternative or complementary therapies that do not involve drugs, such as aromatherapy. Alternative therapies are used in place of conventional care, while complementary therapies are used in conjunction with conventional therapies.

An essential oil is a volatile liquid extracted from various plant parts by steam distillation. Because peppermint oil and other essential oils are organic and have an inherently low molecular weight, they are easily absorbed. Unlike synthetic chemicals or drugs, essential oils do not accumulate in the body. They are excreted via urine, feces, perspiration, and respiration.[10] Peppermint oil causes few adverse reactions, and these occur only with large quantities far greater than anyone was exposed to in this study. Peppermint oil was used in minute levels (3 drops in an inhaler), so the probability of any toxic adverse reactions was minimized. Adverse reactions include double vision, unsteadiness of gait, and euphoria.[11] These adverse reactions spontaneously resolve within 12 hours.

Peppermint essential oil is primarily known for its beneficial effect on the digestive system. Adverse reactions to most antiemetics might be avoided by using peppermint oil as an alternative therapy. Those who get relief from PONV by using peppermint essential oil experience a sense of satisfaction and empowerment. The peppermint gives the participant more choice and control over administration. The inhaler was at the patient's bedside and the patient could choose when to use the inhaler and could use it immediately without having to ask the nurse for medication. Peppermint oil therapy is also less expensive and has a more rapid onset than traditional treatments with antiemetics.[5] In this study, peppermint provided relief in 2 minutes while the average time for relief with ondansetron was 44 minutes.

Literature review

Lua and Zakaria reviewed the evidence about the effectiveness of essential oils for nausea.[12] Five articles met their inclusion criteria, but only three of these studied peppermint oil without additives such as almond, argan, or coconut oil or beeswax. All essential oils can be purchased with or without additives, which extend the life of the oil. In this study, a pure peppermint oil without any additives was used.

Lua and Zakaria reported that the studies suggest, "Peppermint oil not only reduced the incidence and severity of nausea and vomiting, but also decreased antiemetic requirements and consequently improved patient satisfaction."[12] They found some methodological flaws in these studies and stated that further research is needed.

In one study included in this review, Buckle conducted a small clinical trial to assess the effectiveness of undiluted peppermint oil administered via a plastic personal inhaler.[13] Of the 17 participants, 82% reported some level of decrease in nausea. For 47% of these, the reported relief from nausea was complete. Results were statistically significant ($P < 0.001$). (See *Glossary of research terms.*) Lua and Zakaria criticized this study because of its small sample size.[12]

Anderson and Gross conducted a randomized double-blind placebo-controlled study.[14] Thirty-three ambulatory surgery patients were randomly assigned to one of three groups and received aromatherapy pads containing isopropyl alcohol, peppermint, or placebo. Overall nausea scores decreased with the aromatherapy treatment. No significant differences were noted between those who used isopropyl alcohol versus peppermint. Because peppermint oil is alcohol-based, it would be expected to perform similarly to the isopropyl alcohol. Only 52% of the patients required traditional I.V. antiemetic therapy. This seminal study concluded that aromatherapy effectively reduced the perceived severity of postoperative nausea and should be considered a first-line treatment that can be given quickly. This study lacked a control group.

In another study, Tate used an experimental design to investigate the efficacy of peppermint oil as a treatment for postoperative nausea.[11] The sample consisted of 18 patients who underwent major gynecologic surgery. The participants were divided into three groups: control (no treatment), placebo (peppermint essence), and experimental (peppermint oil). Peppermint essence, a solution of essential oil with 50% to 60% ethanol as its base, is four times weaker then pure peppermint oil.[15] The nausea rate was 89% across all groups. Compared with the placebo (peppermint essence) group, the experimental (peppermint oil) group had a statistically significant improvement in self-reported nausea ($P = 0.02$). The sample size in each group was small.

According to Lua and Zakaria, these studies also reported a decrease in antiemetic use.[12] Because of methodological issues, more studies need to be conducted before aromatherapy can be recommended as a replacement for antiemetics.

ASPAN's 2006 Evidence-based Clinical Practice Guideline for the Prevention and/or Management of PONV categorizes aromatherapy as Class IIb, Level B/C.[6] This means the benefit is equal to the risk and performing or administering the treatment is not unreasonable.[2]

Study methodology

This study used a quasi-experimental design in which peppermint oil represented the independent variable and nausea, the dependent variable. The participants provided informed consent during their preoperative visit or postoperatively. All patients were alert and oriented to provide informed consent. If they had not already provided informed consent, patients were asked if they were willing to participate in the study when they transitioned to the step-down unit. The participants were instructed in the peppermint inhaler breathing technique postoperatively when they experienced nausea. Before the study began, nurses who had completed mandatory institutional review board (IRB) training attended a staff-development program to learn how to administer the nausea tool, a 0-to-5 PONV scale,[16] and how to use the peppermint oil inhaler. (*See Nausea scale with descriptors*.)

Demographics. The nurse researcher completed the demographic data sheet by gathering information, mostly from patient medical records. Participants were asked to clarify any missing or conflicting information, including date and type of surgery, any history of gastrointestinal disorders before or after surgery, smoking status, and history of motion sickness or postoperative nausea. Age and gender were obtained from the medical record. (See *Demographics*.)

Sample. The sample consisted of adult postoperative cardiac surgery patients, including those undergoing coronary artery bypass, endovascular repair of thoracic aortic aneurysm, left-ventricular assist device implantation, cardiac implantable electronic device lead revision, valve surgery, and transcatheter aortic valve replacement. To be included in the study, the participants had to be at least 18 years old, understand and speak English, and be willing to try aromatherapy. Potential participants were excluded if they were not willing or able to give informed consent, or if they had an allergy to peppermint or alcohol-based products. A power analysis determined that to achieve an alpha of 0.05, a sample target size of at least 30 was needed. Effect size was based on prior research in this area. Knowing that not all subjects enrolled would experience nausea, the researchers' goal was to obtain informed consent from 100 subjects.

Peppermint oil nasal inhaler. The same research nurse prepared all plastic nasal inhaler tubes. Three drops of peppermint essential oil were applied to the inhalers' highly absorbent cotton wicks, which were inside the inhalers. The inhalers had a seal cap on one end and, at the top of the inhalers, an opening through which the participant inhaled the peppermint oil. Four smaller holes at

Glossary of research terms

Alpha	Tests the degree of possibility of making a Type I error (accepting that a statistically significant difference exists when it does not).[18]
Effect size	The degree of difference between two groups receiving different treatments. One component of determining the number of subjects needed for a study. With a small effect size, a larger number of subjects is needed to determine if a difference exists.[18]
Frequency scores	The number of subjects who exhibit each characteristic. Usually expressed in a count and percentage of the sample.[18]
Pre-post paired t-test	A t-test is used to compare the means of two groups. In this study, the paired t-test compares the means of two groups when subjects have completed both the pre- and posttests. Each subject's score from the pretest is compared to the posttest. In this study, results are presented as t (33) = 7.99, $P = 0.000$. The number 33 is the degrees of freedom, or 1 less than the number of subjects. The calculated t score is 7.99, and the *P* value represents statistical significance, in this case 0.000, which is highly significant.[19]
Mean	Mathematical average[20]
N	Sample size[20]
P	Statistic indicating significance. $P < 0.05$ means the results are significant; the smaller the number, the less likely that the results occurred due to chance.[20]
Power analysis	An analysis completed prior to conducting research to determine how many subjects are needed to determine if statistically significant results can be obtained.[18]
Quasi-experimental design	A study in which subjects are not randomly assigned to an experimental and control group, or one in which there is no control group.[18]
Standard deviation (SD)	Variance or range—the larger the SD, the larger the range of responses.[20]

the base of the inhalers allowed air to enter. As participants inhaled, air circulated up and around the cotton wick, diffusing the essential oil into the participant's nose. When not in use, the inhaler was kept in its container and in a sealed plastic bag to contain the aroma. These precautions were taken to ensure that only participants using the inhaler would smell the peppermint.

Setting. The hospital where this research was conducted is a large academic tertiary care facility in Delaware. The CVCCC comprises large private rooms along a long hallway. This configuration ensured isolation for the participants and minimized any concern about one participant's use of peppermint influencing other participants.

Data collection tools. Because nausea is subjective, participants evaluated their own level of nausea. In a study by Halpin and Bunting, a 0-to-5 PONV nausea scale was evaluated.[16] This tool was developed to simplify nausea assessment in oncology patients receiving chemotherapy. Halpin and Bunting reviewed the literature and derived this tool based on existing tools. The tool, used in 89 patient events, was preferred by nurses over a scale using 0-to-10 ratings. The tool helped nurses communicate with patients and physicians. Although reliability studies were not reported, Halpin et al. concluded that this scale can be reliably used to measure the clinical outcome of treatment modalities.[17]

The nausea scale was chosen for the current study to measure nausea at different times. Participants rated their nausea in the postoperative area when they initially experienced it and then 2 minutes after using the peppermint inhaler. The investigators developed a nausea management algorithm to help maintain fidelity to the research protocol. (See *Nausea management algorithm.*) Upon feeling nauseated, participants were asked to rank their nausea based on the 0-to-5 scale (step 1) and the time was noted. Participants were given the peppermint inhaler and the research nurse taught them how to use it (step 2). Participants placed the inhaler in one nostril, pushed the other nostril closed with their fingers, and inhaled deeply through their open nostril for 3 seconds. Participants chose which nostril to use. Patency of the nostrils was not assessed. They held their breath for 3 seconds, and then exhaled through pursed lips for a count of three. Participants were instructed to do this three times.

Two minutes after using the peppermint inhaler, participants ranked their nausea again using the same 0-to-5 scale (step 2). At any point in the algorithm, the participant could chose to use the I.V. antiemetic instead of the peppermint inhaler.

After participants completed the protocol, they were asked to answer a four-question survey (step 5). They were asked if they were satisfied with their postoperative nausea management and to rank their level of satisfaction on a scale of 1 to 10, with 1 being "not satisfied" and 10 being "very satisfied." Participants were asked if they would be willing to try peppermint oil again for postoperative nausea. They were also asked if they thought peppermint oil should be a treatment option for postoperative nausea.

Nausea scale with descriptors

Number	Measure	Descriptors
0	None	No nausea.
1	None	No nausea. Nausea is anticipated and prophylaxis medications *may* be given.
2	Mild	Nausea persists. Able to tolerate food or medication by mouth.
3	Moderate	Nausea persists. Lacks appetite. Does not feel like eating, but can eat small meals.
4	Great	Nausea ongoing, no appetite, unable to tolerate food or medications by mouth.
5	Severe	Nausea with dry heaves reported.

Source: Halpin A, Huckabay LM, Kozuki JL, Forsythe D. Weigh the benefits of using a 0-to-5 nausea scale. *Nursing*. 2010;40(11):18-20.

Results

Data were coded and analyzed using SPSS software version 20. Descriptive statistical techniques used included frequency scores, cumulative frequency percentages, means, and standard deviations.

Of the 123 participants enrolled in the study, 34 (27.2%) experienced nausea and received the peppermint inhaler. Subjects gave informed consent before they developed nausea; nausea was not an inclusion criterion. Subjects were offered peppermint inhalers only if they developed nausea.

Thirty-four participants completed the nausea scale before and after using the peppermint inhaler. On a scale of 0 to 5, with 5 being the greatest nausea, the average nausea scale rating before peppermint use was 3.29 (SD, 1.0). The average nausea scale rating after using the inhaler once, or 2 minutes later, was 1.44 (SD, 1.3)

with a correlation of 0.34, $P = 0.05$. Participants with ratings of 0 and 1 on the nausea scale after treatment were considered nausea-free by definition. After one peppermint inhaler use, 19/34 (55.8%) participants reported no nausea (ratings of 0 or 1 on the nausea scale) and 8/34 (23.5%) participants reported mild nausea (a rating of 2 on the nausea scale).

Using a pre-post paired t-test, the mean difference in scores from before and after was 1.85 (SD, 1.35), $t = (33) = 7.99$, $P = 0.000$. This indicates a statistically significant difference in nausea scale scores before and after the first peppermint oil inhalation, with improved scores post-peppermint oil inhalation.

Only five participants used the peppermint oil a second time; two participants' nausea ratings then decreased from 5 and 4 respectively to 1. Four of the five (80%) participants who used the peppermint a second time were nausea-free after the second use. The one patient who was not nausea-free experienced relief after receiving the I.V. antiemetic.

Seven participants (20.5%) received I.V. medication. Five of the seven (71.4%) obtained relief from ondansetron, and two did not. The average time to relief with ondansetron was 44 minutes (range, 15 minutes to 1 hour). Most participants who received relief using the peppermint inhaler achieved it with one use of the inhaler, or in 2 minutes.

Thirty participants answered the survey questions at the end of the protocol (step 5). The questions evaluated their satisfaction with the use of peppermint oil in the management of PONV. When asked if they were satisfied with PONV management, 28 (93%) replied yes and 2 replied no. Twenty-eight (93%) of the 30 who answered this survey were willing to try peppermint oil again, and 27 (90%) agreed that peppermint oil should be an option for PONV management. The participant who did not agree that peppermint oil should be an option for PONV rated nausea 4/5 before the peppermint oil and changed the rating to 5/5 after using the peppermint. This participant had a history of gastroesophageal reflux disease (GERD) and hiatal hernia resulting in a constant state of nausea before surgery. This patient received I.V. medication for nausea with limited relief.

Demographics

	All enrolled subjects	Received peppermint oil
Age range	32 to 90	32 to 90
Age mean (SD)	65.82 (12.49)	66.23 (13.52)
Male	78 (63.4%)	16 (47.1%)
Female	45 (36.6%)	18 (52.9%)
Smoker		
Yes	27 (22%)	5 (14.7%)
No	96 (78%)	29 (85.3%)
History of motion sickness		
Yes	26 (21.1%)	10 (29.4%)
No	97 (78.9%)	24 (70.6%)
History of gastrointestinal disorders		
None	60 (48.8%)	13 (38.2%)
GERD	48 (39%)	15 (44.1%)
Diverticulitis	2 (1.6%)	1 (2.9%)
GERD and hiatal hernia	9 (7.3%)	4 (11.8%)
Other	1 (0.8%)	0 (0%)
	Total (N = 120)	Study group (N = 33)

Discussion

This study's primary purpose was to evaluate the use of peppermint oil to manage PONV in cardiac surgery patients. A secondary purpose was to determine participant satisfaction with peppermint oil for PONV. The results support the findings of previous studies using peppermint oil inhalation to manage postoperative nausea.

None of the studies reviewed by Lua and Zakaria or those reviewed by authors of this article included postoperative cardiac surgery patients.[12] This is an important patient population because of the number of cardiac surgery procedures in the United States and the advanced age of many patients undergoing these surgical procedures. Many patients take several prescription and nonprescription medications for comorbidities, increasing the chances of drug interactions. Regardless of patients' ages, antiemetics can cause adverse reactions that complicate the recovery process.

In previous studies, visual analog scales were used to determine levels of nausea. In this study, a nausea rating scale with ratings of 0 to 5 with descriptors was used so participants could define their nausea more consistently. This allowed for more accurate comparisons of nausea before and after treatment and more accurate comparisons of nausea among participants.

Participants were overwhelmingly positive about using peppermint oil to relieve nausea, were willing to try it again for future surgeries, and recommended its routine use for postoperative nausea. One participant with GERD and hiatal hernia did not have nausea relief, even after receiving an I.V. antiemetic, and did not recommend routine use of peppermint oil. Another participant who did not obtain relief was not willing to try peppermint oil again and did not answer the question about routine use. The researchers concluded that peppermint oil inhalation is a viable first-line treatment for nausea in postoperative cardiac surgery patients.

Limitations

One limitation of this study was the large number of nurses involved in data collection. One of the goals of the study was to involve a large portion of the staff to mentor them in the research process. Over 40% of the staff (38 nurses) became IRB-trained to participate in this study. This involvement challenged the researchers' ability to oversee nurses who were implementing the protocol. Data from one participant could not be included because the timing of the data collection did not adhere to the protocol.

Limiting patients' enrollment to the step-down area, rather than including patients earlier in their stay when they were still in the ICU, limited the number of eligible participants. Patients experienced nausea before being transferred to the step-down unit, impacting the number of patients recruited. This may also account for the lower percentage of patients reporting nausea and being eligible for the study. This study found a lower percentage of participants (28%) who experienced nausea compared with what is reported in the literature.[6] When nurses in the ICU began asking to use peppermint oil for their patients, the protocol was amended to include patients in the immediate postoperative period, capturing a greater number of participants.

In hindsight, researchers agree that obtaining a baseline of routine I.V. antiemetic use would have been helpful. This data would have shown if using peppermint oil decreased the overall need for I.V. antiemetic use.

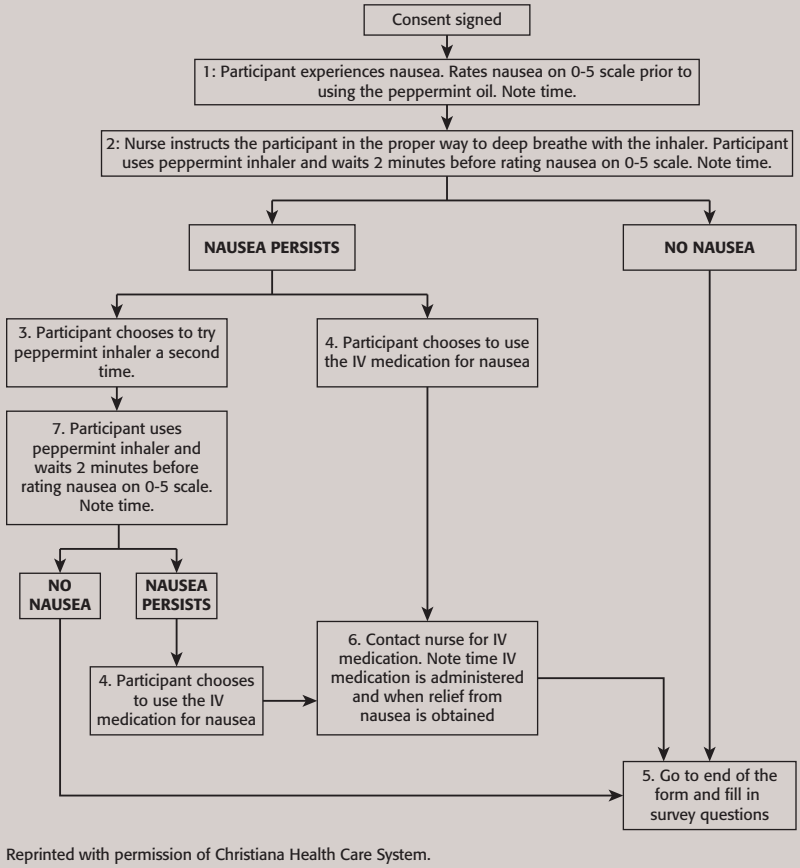
Implications for further research

Further study is needed to quantify the effect of peppermint oil on the subset of surgical patients with underlying gastrointestinal disorders. Patients in the early postoperative period should be studied to determine if immediate use of peppermint oil can reduce the use of I.V. antiemetics.

Implications for nursing practice

For participants who obtained relief of nausea, peppermint oil inhalation worked within minutes. Using peppermint oil first to control postoperative nausea is a cost-effective, fast-acting approach. It should be the first-line agent of choice. Using peppermint oil is within the scope of nursing practice, and it is now used in the CVCCC routinely as a nursing intervention for postoperative nausea.

Nausea management algorithm



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No healthcare provider prescription is needed. This initiative is becoming a systemwide practice. ■

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