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Abstract

Post-operative nausea vomiting (PONV) is one of the most common complications after surgery and a significant cause of dissatisfaction among post-operative patients. Traditional first line treatment of PONV with antiemetic medications can cause severe side effects and can have compounding interactions with other medications. Aromatherapy has been increasing in popularity for the treatment of PONV due to its safety, absence of drug interaction and side effects, and rapid onset due to ease of administration and patient driven treatment. This study looks at a trial of QueaseEASE, an aromatherapy product for PONV, at a hospital in the Pacific Northwest. Overall initial findings suggest high patient satisfaction of treatment with QueaseEASE. Preliminarily, the trial shows a reduction in the use of antiemetic medications, however, more data is needed to show statistical significance.

Background

Post-operative nausea vomiting (PONV) is a common surgical complication, occurring in 10%-30% of all patients and as high as 70% to 80% for high risk patients (Briggs, Hawrylack, & Mooney, 2016). Several risk factors for PONV have been identified such as being female, being a nonsmoker, having a history of PONV or motion sickness, and perioperative opiate exposure (Apfel, Läärä, Koivuranta, Greim, & Roewer, 1999). These risk factors are commonly used to create a PONV risk score with an addition of each variable predicting a greater likelihood someone will experience PONV. The pathways that lead to PONV can be complex and variable for different patients. The vomiting center in the brain lies in the medulla oblongata which can be stimulated by four areas: the gastrointestinal tract, cerebral cortex and thalamus, vestibular region, and chemoreceptor trigger zone (CRTZ) (Becker, 2010). Opiate medications received

during and after surgery can induce nausea and vomiting mainly through the CRTZ as well as the gastrointestinal tract (De Pradier, 2006). The CRTZ lies close to the vomiting center in the brain and is unique because it is not protected by the blood brain barrier like other brain structures (Becker, 2010). Chemical changes in the blood can affect the CRTZ and induce vomiting. The gastrointestinal induction of nausea and vomiting is produced by the loss in tone in the gastric fibers resulting in slowing the emptying of the stomach (De Pradier, 2006).

Antiemetics used to treat PONV can vary in effectiveness and often have undesired side effects (Briggs et al., 2016). The first class of common antiemetic medications used to treat PONV are dopamine antagonists such as prochlorperazine (Compazine) and metoclopramide (Reglan) which can be effective in treating most causes of PONV including stimulation from the CRTZ as well as the gastrointestinal tract (Becker, 2010). The potential harmful side effects from dopamine antagonists include sedation, hypotension, and extrapyramidal syndromes (Omudhome, 2017). The most common extrapyramidal syndrome caused by prochlorperazine is called akathisia which causes patients to feel restless and a compelling need to move (Becker, 2010). The next class of common antiemetic medications is 5-HT3 (serotonin) antagonists, the most commonly used is ondansetron (Zofran) (Becker, 2010). Some side effects of ondansetron include headache, lightheadedness, abnormal liver enzyme production, and arrhythmias (Williams, 2017). Lastly, another common class of antiemetic medication used to treat PONV is antihistamines which include meclizine (Antivert) and scopolamine (Hyoscine) (ASPAN's evidenced-based, 2006). Common side effects of these medications include sedation, dry mouth, blurred vision, and specifically Scopolamine can cause renal or hepatic impairment (ASPAN's evidenced-based, 2006, Stoppler, 2019).

The sedative effects of many of the classes of antiemetic medications can disrupt a patient's ability to cough and deep breathe which are critical when recovering from anesthesia (Briggs et al., 2016). If not successfully treated, PONV can lead to more severe post-operative complications such as dehydration, electrolyte disturbance, aspiration, and wound dehiscence. This can lead to increase post-anesthesia care unit (PACU) length of stay and unplanned hospital admission (Hines, Chang, Gibbons, 2018). PONV is one of the highest reported concerns among patients before surgery and one of the main causes of dissatisfaction from patients (Hines et al., 2018).

Aromatherapy is described as the use of essential oils to treat physical or psychological symptoms (Herz, 2009). Two main mechanisms for how aromatherapy produces its effects have been proposed: the first being the pharmacological hypothesis, secondly the psychological hypothesis. The pharmacological hypothesis suggests that that the components of the essential oils directly interact and affect the nervous and endocrine system. Lavender, which is known for it's calming and sedative effects, has been shown to act postsynactpically - where it has been proposed to regulate the activity of cyclic andenosine monophosphate (cAMP). The reduction of cAMP activity is correlated with sedation (Herz, 2009). Thus suggesting that lavender essential oil is acting through a neuropharmacological mechanism. Several other studies have shown that rats exposed to the vapors of essential oils have detectible levels of aromatic compounds in the blood stream. This suggests that these compounds could be absorbed by way of the nasal or lung mucosa and act pharmacologically (Herz, 2009). However, no studies in humans have shown inhaled vapors having any detectable compounds in the bloodstream or other physiological pathways. Another issue raised for the pharmacological hypothesis is it takes at least 20 minutes for a compound to circulate through the bloodstream and across the blood-brain barrier. Many

studies report responses to aromatherapy being immediate, which conflicts with the mechanism of action being via bloodstream (Herz, 2009).

Another mechanism of action proposed by the pharmacological hypothesis is direct interaction of the odorants with neural substrates that would produce a more immediate response. In order for either mechanism to produce the physiological response there must be receptor-ligand binding where the aromatic compound binds to a specific receptor site. This would suggest that the structure of the compound is crucial in producing the desired effect (Herz, 2009). Several studies have tested this structure-function relationship by using chemically identical molecules with different orientations. One study looked at the autonomic and self-evaluated measures of mood using enantiomers of limonene and carvone (Heuberger et al., 2001). The enantiomers were found to produce different autonomic and self-evaluated results, however, the difference in scent was detectible, so a perceptual-psychological contributing factor cannot be ruled out (Heuberger et al., 2001). Another study done by Kuroda (2005) and colleagues looked to eliminate this confounding variable by reducing the concentration of the odorant to below a detectible threshold. This study looked at enantiomers of linalool and found both physiological and psychological differences (Kuroda et al., 2005). Despite these studies, there have been many others that looked at different variants of the same odor, often a natural and artificial one, and found similar physiological and psychological effects, suggesting that the perception of the odorant produces the aromatherapy effects (Herz, 2009).

The psychological hypothesis proposes that aromatherapy has an effect through an emotional learning, perception, and belief/expectation. This hypothesis claims that the response to odors are produced by associative learning which is when events or items become linked to

one another through experience (Herz, 2005, 2009). Scents have long been known to be associated strongly with memories due to the proximity of the olfactory nerve to the amygdala that is responsible for expression and experience of emotion. The amygdala is also closely associated to the hippocampus, which transmits information from working memory to short-term and long-term memory (Herz, 2009). Multiple studies have shown that responses to odors can be produced by associative learning. One study showed that adult participants who were afraid of the dentist showed a fear response when exposed to the scent of eugenol (a common component of dental fillings) (Herz, 2005). Another example is a study done by the U.S. military to try and make a universal stink bomb but could not find a cross-culturally dislike of the scent (Herz, 2005). Another compelling example for associative learning and odors is a study done in 1966 that looked at perceptual responses to different common scents(Herz, 2005). They found in Britain wintergreen was one of the lowest rated scents, where in America it was one of the highest rated. This difference was explained by the use of wintergreen in Britain as a common flavor for medicine where in America it was exclusively used in candy and sweets (Herz, 2005). A study done by Epple & Herz (1999) showed that participants exposed to a novel odor when completing a difficult or frustrating task were later less motivated and subsequently spent less time willing to engage in a new unrelated task when re-exposed to the same odor. Another study found that the suggestion of a scent as producing a desired response was more important than the scent itself (Campenni, Crawley, & Meier, 2004). This study compared lavender, neroli, and a placebo, and examined changes in heart rate and skin conductance. They found that when the scent was suggested to be relaxing all three produced a decrease in heart rate and skin conduction; similarly, when the scents were suggested to be stimulating it was found that all three scents produced an increase in heart rate and skin conduction. The psychological

hypothesis for aromatherapy is currently the best model by which associated learning can produce emotional, behavioral and physiological effects (Herz, 2009).

The use of aromatherapy to treat PONV has been commonly used in postanesthetic care units, mainly with isopropyl alcohol found in 'prep-pads'. This practice is said to be a traditional South American nausea relief remedy, which has been widely used in American hospitals before studies that justified the clinical effectiveness (Hines et al., 2018). More recently, aromatherapy has been suggested as an alternative treatment for PONV due to its safety, lack of drug interaction and side effects, and rapid onset due to ease of administration and patient driven treatment (Asay, Olson, Donnelly, & Perlman, 2018). The use of aromatherapy could also provide a financial incentive to the hospital. Two of the most commonly used antiemetic medications: prochlorperazine and ondansetron cost an average of $13.99 and $51.98 respectively in 2004 to successfully manage a patients PONV (Chang, 2005). The cost of one QueaseEASE tab that lasts 72 hours is $6 (Medical, n.d.). The American Society of PeriAnesthesia Nurses now includes aromatherapy in the clinical guidelines for treating PONV (ASPAN'S Evidence-Based, 2006).

Literature Review

A large meta-analysis published in the Cochrane Database of Systematic Reviews, consisting of 16 different studies, conducted in March of 2018, looked at the use of aromatherapy with isopropyl alcohol (IPA), various essential oils, and blends to treat PONV (Hines et al., 2018). All of the studies were either randomized controlled trials or controlled clinical trials on postoperative patients in a PACU setting or day surgery unit. The results were broken into four groups: summary of overall findings, peppermint compared to placebo, isopropyl alcohol

compared to the standard treatment, isopropyl alcohol compared to placebo. Overall, more patients who received aromatherapy as first line treatment for PONV compared to those who received a placebo were nausea free at the end of treatment. Another major finding was that fewer patients who received aromatherapy compared to a placebo required rescue antiemetic medications. It was also found, however, that there was no difference in the reduction of nausea severity in the aromatherapy groups vs. placebo (Hines et al., 2018). Of all the 16 studies used none reported any adverse events or allergic reactions. Of the studies that measured patient satisfaction, overall high levels of satisfaction were reported. Four of the 16 studies looked at peppermint compared to placebo with the meta-analysis showing little to no difference in the severity of nausea (Hines et al., 2018). Three studies looked at isopropyl alcohol compared to the standard of care and found that the aromatherapy group had significantly faster relief. The results also showed a reduction in the use of rescue antiemetics (Hines et al, 2018). Lastly, three studies looked at isopropyl alcohol compared to a placebo, however, the meta-analysis on the severity of nausea was not able to be performed due to differenced in measuring and data reporting. The Cochrane Database of Systematic Review ultimately found that the quality of the evidence was low and that more research is needed. It was also concluded that there was insufficient evidence for the use of ginger or blends to treat PONV due to lack of data, but the authors noted positive results in individual studies. Finally, the authors concluded that aromatherapy may be a simple and inexpensive therapy but should be used complementary to pharmacological antiemetics (Hines et al., 2018).

Other reviews published after the Cochrane Review, such as one done in August of 2018, found that 3/5 studies reviewed had statistically significant results that the use of aromatherapy decreased PONV, with the most effective therapies using peppermint, ginger, or blend of peppermint, ginger, lavender, and spearmint oil (Asay et al., 2018). They also found overall high

patient satisfaction with the aromatherapy treatment. Another study not included in the Cochrane Review that was published around the same time looked at the use of QueaseEASE, an aromatherapy product that delivers a blend of peppermint, ginger, lavender, and spearmint oil, compared to the standard of care (Stallings-Welden et al., 2018). There was no perceived difference in the effectiveness or timeliness between the two treatment groups. In this study aromatherapy was found to be as effective as the standard of care but carries less risks that accompanies the use of antiemetics. Other studies done focused on patient satisfaction and quality improvement using QueaseEASE showing positive results (Amedio, 2016; Hodge, McCarthy, & Pierce, 2014; Malone, 2017) These studies showed higher patient satisfaction in the QueaseEASE treatment group as well as a reduction in the use of antiemetic medications.

Thesis Question

Does the use of aromatherapy to treat PONV decrease the use of recue antiemetics and/or PONV related hospitalizations? Additionally, are patients satisfied with the treatment of their PONV with aromatherapy?

Theoretical Framework

There are several key principles that guide process improvement in order to promote change in a healthcare setting. The first being that quality improvement is the science of process management. In a healthcare setting this amounts to focusing on one process at a time that needs improvement in order to make big changes in quality of care. (Haughom, 2016). The next principle is that if you can't measure it you can't improve it. In order for the trial of QueaseEASE to be found successful there must be quantitative and qualitative data to show that it is improving the goals set. Next, there must be the right data, in the right format, at the right

time. This can be a challenge because if there is not literature that help guides your process improvement, choosing the right data to look at can be daunting. Lastly, there must be engagement with clinicians for the change. If the team is not educated and onboard with the change then it won't be successful (Haughom, 2016). In order to meet all these criteria for process improvement, Lippett's change theory was chosen as a theoretical framework to analyze and promote the change of implementing an alternative first line treatment for PONV. Lippett's change theory incorporates all the elements of successful process improvement and allows the change agent to organize the change in a scientific way. Lippett's change theory consists of seven phases (Kritsonis, 2005):

1. Diagnose the problem
2. Assess the motivation and capacity for change
3. Assess the resources and motivation of the change agent
4. Choose progressive change objects including developing plans of action and strategies
5. Determine the role of the change agent and that it is clearly understood by all parties so that expectations are clear
6. Maintain the change including communication, feedback, and group coordination
7. Gradually terminate from the helping relationship with gradual withdrawal of the change agent

Phase 1 does not have a clearly defined start date because the need for effective antiemetic medications with limited side effects is ongoing. The proposed use of aromatherapy in the hospital of interest started in October 2018 with a peaked interest from a MAGNET presentation. To further diagnose the problem a baseline use of recuse antiemetic medication and hospitalizations due to PONV was determined. Phase 2 was motivated by a desire to provide

better holistic care to patients suffering from PONV. Interest from the PACU care team about aromatherapy led to the conclusion that there is capacity to change. A strength-weakness-opportunity-threat (SWOT) analysis was constructed to assess barriers to change (Table 1). In phase 3 I identified my thesis advisor Melissa Schmidt as my main resource and the Nurse Clinical Leader of the PACU. In phase 4 the plan of action was determined to be a 60-unit trial of QueaseEASE with an associated questionnaire (Figure 1) to start in May 2019. Project leader Denise Smith was identified as an interested party to implement, guide, and preside over the trial. Objectives of this change is to reduce the use of rescue antiemetics and PONV related hospitalizations. Other objectives include evaluating nurse and patient satisfaction with aromatherapy treatment for PONV. In phase 5 I put together a presentation and was part of the education given to the nursing staff on the implementation of the aromatherapy and how to use the questionnaire. I evaluated and processed data collected from looking at charts and reviewing the questionnaires. My nurse clinical leader and I made everyone aware that I was a resource for questions and concerns about the implementation. Phase 6 will involve reflection and feedback on the aromatherapy to determine effectiveness and satisfaction. If and when effective implementation is established, Phase 7 can begin. Phase 7 must include securing QueaseEASE as a product that is being ordered regularly as well as implementing continued training for new nurses to the PACU. An overview of Lippett's phases in respect to the project can be found in Figure 2.

Methods

In order to implement and maintain aromatherapy with QueaseEASE as a first line defense for PONV evidence was collected for the effectiveness in treating PONV, the use of

rescue antiemetics, and patient satisfaction. A retrospective evaluation was completed of the frequency of rescue antiemetics used in the PACU, PONV score, type of surgery, intraoperative antiemetic medication use, and hospitalizations due to PONV between January 1, 2019- April 1, 2019. These measures were then compared after the implementation of QueaseEASE as first line PONV treatment with the use of a questionnaire. Patient perceived effectiveness and satisfaction with the product was also evaluated using the questionnaire (Figure 1). The first part of the questionnaire was administered at the bedside in the PACU. The second part of the questionnaire was administered in person on the ward or by phone call post-op. Nurse-education trained staff on how to administer the aromatherapy as well as how to use the questionnaire for evaluation. The training consisted of a 15 minute in-service with information on why aromatherapy was being trialed for the treatment of PONV, what the purpose of a trial period is, and how to administer and evaluate QueaseEASE. The PONV risk score of the pre-aromatherapy and post-aromatherapy groups were compared using a paired t-test. The PONV severity score was compared before and after 5 minutes of QueaseEASE administration and a paired t-test was conducted to determine if there was a significant difference in the groups.

Results

From the period of January 1, 2019 to April 1, 2019 there was 49 incidences of PONV with 94% of those patients receiving at least one form of prophylactic nausea treatment. The average number of prophylactic treatments given was 1.55 per patient. All of the patients who experienced nausea received at least one rescue antiemetic medication with the average number being 1.33 per patient. The average PONV risk score for this group was 2.14. There was one incident of a planned out-patient converting to inpatient from PONV in this timeframe.

After the implementation of QueaseEASE, in the first month there was 12 incidences of PONV with 81% of those patients receiving at least one form of prophylactic treatment. The average PONV risk score of this group was 2.63; there was no significant difference in the risk score in the pre and post group ($p > 0.10$). The average number of rescue antiemetic medications given per patient after the implementation of QueaseEASE as first line PONV treatment was 0.5. A t-test was not able to be performed on the amount of rescue antiemetic medications used due to large difference in sample size. The average nausea rating before the aromatherapy treatment was 1.8 and after treatment was 1, however, there was no statistically significant difference in the ratings ($p > 0.05$). The most common reported level of nausea after treatment was a 1 which was indicated as mild.

In the post-operative follow-up patients were asked to rate the effectiveness out of 5 and the average rating was 4.1. Overall 90% of patients said they would use QueaseEASE again.

Discussion

Despite the difference in sample size, the results show a comparable PONV risk score as well as number of patients who received prophylactic antiemetic medications in the pre and post aromatherapy group; this leads to the belief that these groups are comparable to one another. There was a reduction in the average number of antiemetics given from 1.33 to 0.5 per patient, however, as mentioned before, a t-test was not able to be performed. These preliminary results support the continuation of Lippett's change theory phase 6: maintain the change including communication, feedback, and group coordination. The change will remain with continued feedback from patients and staff, as well as continued data collection. One of the goals was to show if there was a reduction in the number on rescue antiemetics being used, the ability to show

that there is a significant difference would allow support to move to phase 7 where there would be termination of the helping relationship of the change agent. In order to reach phase 7, the hospital must acquire QueaseEASE as a regularly ordered product. The reduction in the use of more expensive rescue antiemetics will provide incentive for hospital executives to support this change. There was not a large enough sample to show if there was a reduction in hospitalization due to PONV.

There was variation in patients reported change in nausea with aromatherapy treatment. The most common nausea scale rating after treatment was mild (1). Some patients reported no change in the severity of nausea while others reported no nausea after treatment. The small sample size leads to the belief that there may not be enough data to show significant results. Again, this supports the continuation of phase 6 to allow for a larger amount of data.

The results show overall positive patient satisfaction with a rating of effectiveness of 4.1/5 as well as 90% of patients saying that they would use QueaseEASE again. This combined with anecdotal evidence of patients expressing that they would like to be able to purchase their own, as well as one patient asking for more when he was continuing to experience post-discharge nausea while staying at the hospital, there is support for the change.

Conclusion

Aromatherapy for treatment of PONV has been increasing in popularity among hospitals and patients with increasing evidence for the effectiveness. Aromatherapy allows nurses to initiate treatment without a physician's orders and allows patients alternative options and power in the decision making about their care. The data supports the continuation of Lippett's phase 6

and suggests that complementary treatment with aromatherapy is well-received and provides a satisfactory experience for patients.

Tables

Table 1: A Strength-weakness-opportunity-threat (SWOT) analysis is a good way to organize motivations to change and analyze potential barriers to change.

Strength	**Weakness**
• Low risk intervention • Inexpensive intervention • Staff invested in improvement • Change agent committed to project success	• Not well-established research on aromatherapy for PONV • Public misconception of aromatherapy • No literature standard for PONV scale
Opportunities	**Threats**
• Innovation on the unit level • Decrease use of rescue antiemetics • Decreased hospitalization due to PONV • CNA contribution to nurse improvement project	• Resistance of staff to change first line treatment • Patient refusal • Long process to acquire new product in the medical center

Figures

Please complete if you use QueaseEase with your patient

Immediate Post-Operative Nausea Scale (PONV):

___ (0) None ___ (1) Mild ___ (2) Moderate ___ (3) Severe

Was QueaseEASE used as first line rescue remedy for PONV? ___ Yes ___ No

Post-Operative Nausea Scale After 5 minutes exposure to QueaseEASE:

___ (0) None ___ (1) Mild ___(2) Moderate ___ (3) Severe

Did the patient feel that the QueaseEASE was beneficial? ___ Yes ___ No

If No, was rescue medications used to treat PONV? ___ Yes ___ No

Please specify the rescue medication and dosage used: _____

_____

Was the patient admitted to the hospital for PONV related complications? ___ Yes ___ No

Is the patient willing to be contacted for follow-up regarding QueaseEase?

Name_____

Contact information_____

How effective was QueaseEASE in relieving your nausea or vomiting?

___ (5) Very Effective ___ (4) Somewhat Effective ___ (3) Neutral

___ (2) Not Very Effective ___ (1) Not at all Effective

Would you use QueaseEASE again if you were experiencing PONV? ___ Yes ___ No

Figure 1: Example questionnaire used to determine QueaseEASE effectiveness and patient satisfaction

Lippett's Change Theory Stages	Description
1. Diagnose the problem	Determine baseline antiemetic use and the hospitalization due to PONV. Develop communication between team members to gain prospective on the problem
2. Assess the motivation and capacity to change	Establish relationship with clinical leader. Construct SWOT analysis to determine motivation and barriers to change
3. Assess the resources and motivation of the change agent	Collaborate with clinical leader to create vision for change. Evaluate motivation, skills, and time needed for this change
4. Choose progressive change objectives including developing plans of action and strategies	Analyze retrospective data to create objective for reduction. Finalize questionnaire and participate in nurse education
5. Determine the role of the change agent and that it is clearly understood by all parties so that expectations are clear	Collaborate with clinical leader to establish my role and communicate to team
6. Maintain the change including communication, feedback, and group coordination	Implement change and work with clinical leader to assess if the change was successful. Use data and nurse feedback to evaluate improvement
7. Gradually terminate from the helping relationship with gradual withdrawal of the change agent	Continue to evaluate data compared to baseline. Remove change agent as aromatherapy becomes first line treatment for PONV

Figure 2: Lippett's stages with a description of my goals in each stage

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