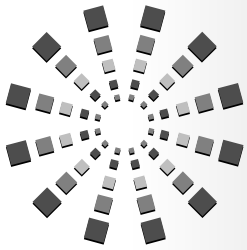
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Effect of Inhalation Aromatherapy on Procedural Pain and Anxiety After Needle Insertion Into an Implantable Central Venous Port Catheter

A Quasi-Randomized Controlled Pilot Study

KEY WORDS
Anxiety
Inhalation aromatherapy
Nursing
Port catheter
Procedural pain

Background: Needle insertion into an implantable central venous port catheter may lead to procedural pain and anxiety in cancer patients. **Objective:** The aim of this study was to determine the effects of inhalation aromatherapy on procedural pain and anxiety after needle insertion into an implantable central venous port catheter. **Methods:** This study included 123 cancer patients who were scheduled to undergo chemotherapy. Patients were randomly assigned to either the lavender group (n=41), the eucalyptus group (n=41), or a control group (n=41). Participants in the intervention groups inhaled 3 drops of essential oil for 3 minutes before needle insertion into an implantable venous port catheter. Patients in the control group received no intervention before needle insertion. Data were collected using the visual analog scale (VAS) and State Anxiety Inventory. **Results:** The average VAS scores of the lavender group were significantly lower than those of the control group ($P<.05$). There were no significant differences in the average VAS scores between the eucalyptus group and the control group ($P>.05$). In addition, the average State Anxiety Inventory scores of the lavender group, the eucalyptus group, and the control group were not significantly different ($P>.05$). **Conclusion:** Inhalation aromatherapy with lavender may be an effective technique to relieve pain related to

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needle insertion into an implantable central venous port catheter. **Implications for Practice:** Inhalation aromatherapy with lavender oil may be useful in the management of procedural pain levels during needle procedure. However, further randomized controlled trials are needed to validate this study.

Central venous access devices (CVADs) enable rapid dilution and dispersion of medications and solutions and reduce repetitive venipuncture.[1] Types of CVADs include nontunneled catheters, tunneled central catheters, peripherally inserted central venous catheters, and implantable central venous port catheters.[2–4] Implantable central venous port catheters have become one of the most commonly used types of CVADs in cancer patients owing to their advantages, which include lower complication rates, their aesthetic appearance, the possibility of treatment at home and in outpatient chemotherapy units, and the opportunity for activities such as swimming, exercising, and bathing. Hence, implantable venous port catheters positively impact the daily lives of cancer patients.[4–6] Despite these advantages, needle insertion into an implantable central venous port catheter may induce procedural pain and anxiety in patients.[7,8]

In 2 studies, 56% to 70% of the adult patients with hematologic malignancies reported procedure-related pain during bone marrow aspirations and biopsies.[9,10] Perhaps relatedly, medical procedure–related anxiety occurs in 25% to 32% of the cancer patients.[10,11] Medical procedure–related pain and anxiety can reduce compliance with treatment, cause difficulties with the treatment procedure, and increase physical discomfort.[12–14] In addition, medical procedure–related pain and anxiety may place burdens on cancer patients.[15] Limited data exist regarding levels of procedural pain and anxiety in cancer patients because most studies have been focused on cancer-related pain and anxiety.[16–18]

There are multiple different approaches to the management of procedural pain and anxiety in cancer patients during medical procedures, including pharmacological and nonpharmacological methods.[8,19–23] Nonpharmacological methods such as aromatherapy are preferred for the management of procedural pain and anxiety because of adverse effects such as oversedation, confusion, fatigue, and nausea that may result from pharmacological methods.[24–26] Aromatherapy, defined as the therapeutic use of essential oils extracted from plants, is inexpensive and safe for the relief of pain and anxiety. Lavender, eucalyptus, sage, lemon, and marjoram essential oils have anxiolytic and analgesic effects in the management of pain and anxiety.[27,28] Lavender (*Lavandula officinalis*) and eucalyptus (*Eucalyptus globulus*) essential oils have traditionally been widely used because of their anxiolytic and analgesic properties.[27,29] Relevant publications in the literature indicate that lavender and eucalyptus essential oils showed promising effects on procedural pain and anxiety.[30–32] To the best of our knowledge, no study has thus far evaluated the influences of inhalation aromatherapy on procedural pain and anxiety after needle insertion into an implantable central venous port catheter.

■ Theoretical Framework

The middle-range Theory of Unpleasant Symptoms (TOUS) was used as the framework for this pilot study. According to the TOUS, each symptom can occur alone or in combination with other symptoms.[33,34] This theory postulates that multiple symptoms can exist simultaneously and may be related.[33] In the TOUS, procedural pain associated with needle procedure can produce anxiety in cancer parents. Increased anxiety can lead to more experienced pain during the needle procedure. The 3 major components of the theory are the symptoms, the influencing factors, and the performance outcomes. Each symptom can vary in duration, intensity, quality, and distress. The influencing factors are categorized into physiological, psychological, and situational factors. Performance is the outcome of symptoms.[34] The theory is available to design nonpharmacological interventions to management of unpleasant symptoms in cancer patients.[35] The aim of this pilot study was to alleviate the severity of procedural pain and anxiety during needle insertion into an implantable venous port catheter using inhaler aromatherapy. According to the TOUS, nursing interventions are to decrease the intensity, quality, timing, and distress of the symptoms of procedural pain and anxiety during needle procedures. Guided by the theory, factors such as age, gender, and history of needle insertion into an implantable venous port catheter were included in this study.

■ Methods

Objective and Study design

This study was a quasi-randomized controlled pilot study examining the effect of inhalation aromatherapy on procedural pain and anxiety during needle insertion into an implantable venous port catheter.

Setting and Participants

The study was conducted in the outpatient chemotherapy unit of an oncology hospital in Ankara, Turkey, and included all cancer patients with implantable venous port catheters scheduled to undergo chemotherapy. The inclusion criteria were (1) age of 18 years or older, (2) visual analog scale (VAS) score of 0 point before the procedure, (3) sufficient level of consciousness, and (4) voluntary participation in the study. Exclusion criteria included (1) a history of dermatitis or respiratory diseases or an allergy to lavender or eucalyptus; (2) use of painkillers in the past 3 hours; (3) use of any antidepressant, hormonotherapy, or complementary-alternative therapy modalities; or (4) a problem with the sense of smell. According to the Power

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Analysis and Sample Size Program (NCSS, LLC, Kaysville, Utah), the minimum sample size was calculated as 123 patients for a power of 0.90 and an α of .05. Stratified randomization was used to balance the research groups with respect to age, gender, and history of needle insertion into an implantable venous port catheter.

Of the 153 assessed individuals, 30 were ineligible (15 diagnosed with asthma, 5 using an antidepressant, 5 taking painkillers in the past 3 hours, and 5 disliking the smell of lavender or eucalyptus). Therefore, 123 patients were randomly assigned to the study groups. The first patient was assigned to the control group (n = 41), the next was assigned to the lavender group (n = 41), the next was assigned to the eucalyptus group (n = 41), and so on.

The patients in the lavender group were administered aromatherapy inhalation of lavender essential oils before needle insertion into an implantable venous port catheter. Similarly, aromatherapy inhalation of eucalyptus essential oils was administered to the eucalyptus group before needle insertion. No intervention was performed for patients in the control group before needle insertion (Figure). In this study, it was impossible to completely blind the subjects because of the characteristic odors of the essential oils used in the aromatherapy.

ETHICAL CONSIDERATIONS

This study was approved by the human research ethics committee of Turgut Ozal University, Ankara. Before beginning the study, the research aim was explained to all patients and written informed consent was obtained. The participants could withdraw from the study at any time and for any reason.

■ Interventions

PROCUREMENT OF THE ESSENTIAL OILS

Lavender (*Lavandula officinalis*) and eucalyptus (*Eucalyptus globulus*) essential oils were obtained from an essential oil manufacturer and were stored in 10-mL lightproof glass bottles in cool and dry conditions. These glass bottles were kept tightly closed to prevent contact of the essential oils with oxygen. According to gas chromatography analysis certificates, the lavender and eucalyptus essential oils were of good quality. Linalyl acetate, linalool, and c-b-ocimene + limonene were the major constituents of the lavender essential oil. The major constituents of the eucalyptus essential oil were 1, 8-cineole, limonene, and a-pinene.[36–39]

Procedure

Persons who met the inclusion criteria and provided written informed consent were enrolled in the study. In the lavender group, 3 drops of lavender essential oil were placed on a cotton swab and fixed at a 10-cm distance from the patient's nose. The lavender group inhaled the essential oil for 3 minutes with normal breathing before needle insertion into an implantable venous port

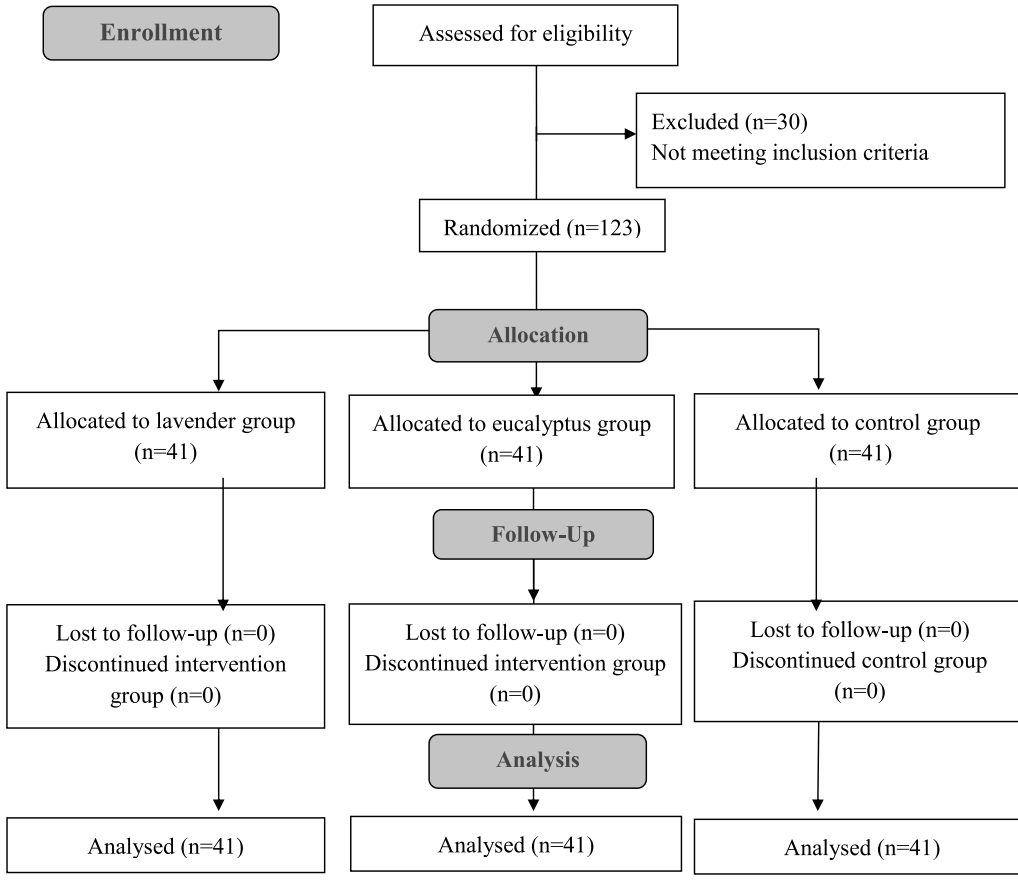


Figure ■ Flow chart of the study protocol.

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catheter. A similar procedure was followed in the eucalyptus group. No intervention was performed for participants in the control group before needle insertion. After completion of the inhalation, the needle was then inserted into the implantable venous port catheter by a clinic nurse. Implantable port needles of the same size and type (20 gauges) were used for all patients.

Outcome Measures

Data were collected using a pain VAS and the State Anxiety Inventory (STAI-I) by face-to-face interviews in the outpatient chemotherapy unit.

Sociodemographic and Clinical Variables

Sociodemographic and clinical variables of the sample were recorded based on previous studies[36,38,40] and contained questions on sociodemographic information (age, gender, marital status, and body mass index) and patient- and treatment-related characteristics (diagnosis, chemotherapy regimen, number of cycles of chemotherapy, and use of complementary-alternative therapies).

■ Instrument

Visual Analog Scale

The level of pain was measured using the VAS pain scale. This is a horizontal scale, ranging from 0 (no pain) on the left side to 10 (most severe pain) on the right side. Pain intensity can be categorized as mild (score, 1–3), moderate (score, 4–6), and severe (score, 7–10) according to the scale.[41,42]

State Anxiety Inventory

The level of anxiety was evaluated by the STAI-I. The STAI form was used to determine the transitory emotional state and anxiety level of the participants after the procedure. This scale, consisting of 20 items, uses a 4-point Likert scale in which items are scored from 1 (not at all) to 4 (very much). The assessment of the inventory is based on the total score ranging from 20 to 80. A score from 1 to 20 is considered to indicate no anxiety, a score of 21 to 40 indicates mild anxiety, a score of 41 to 60 indicates moderate anxiety, and a score of 61 and higher indicates severe anxiety. In a Turkish validity and reliability study, the internal consistency coefficients ranged between 0.94 and 0.96 and test-retest reliability was 0.26 to 0.68.[43]

Data Collection Procedures

Sociodemographic and clinical variables of the sample were recorded on the first day of chemotherapy. After needle insertion, all participants in the 3 groups were asked to report their pain levels during needle insertion into the implantable venous port catheter according to the VAS. Subsequently, all participants were administered the STAI-I to evaluate current anxiety levels.

Data Analysis

All data were analyzed using SPSS version 23.0 (IBM Corp, Armonk, New York). Percentages, frequencies, means, and standard deviations were used to define patients' descriptive characteristics. χ^2 Tests were used for categorical data analysis. The Kolmogorov-Smirnov test confirmed the normal distribution of data in all groups. The independent samples *t* test, 1-way analysis of variance to compare the control and intervention groups, and Pearson correlation for relationships among quantitative variables were also used. Tukey honest significant difference post hoc test was used for defining the differences. The level of statistical significance was set at $P<.05$ for analyses.

■ Results

Sociodemographic and Disease- and Treatment-Related Characteristics

Participants' mean age was 53.74 ± 11.49 years (range, 26–79 years). Most (68.3%) were female. Most participants in all 3 groups were married (97.6% in the lavender group, 90.2% in the eucalyptus group, and 87.8% in the control group). The most prevalent diagnosis in the lavender group (56.2%), in the eucalyptus group (46.4%), and in the control group (51.2%) was breast cancer. In addition, the mean duration of time since diagnosis was 31.75 ± 39.91 months. The mean number of cycles of chemotherapy in all groups was 5.79 ± 8.11. Most participants in all groups (97.6%) had a history of needle insertion into an implantable venous port catheter. Most had never used any complementary therapies (87.8% in the lavender group, 82.9% in the eucalyptus group, and 90.2% in the control group). Of those who did use complementary therapy, the most commonly used type was herbal therapy. Regarding stratification criteria, there were no statistically significant differences among the groups in relation to age, gender, or history of needle insertion into an implantable venous port catheter (all $\chi^2 = 0.000$, Ps = 1.000).

Impact of Inhalation Aromatherapy on Procedural Pain and Anxiety During Needle Insertion Into an Implantable Venous Port Catheter

The mean VAS scores in the lavender group, the eucalyptus group, and the control group were 2.37 ± 1.62, 3.19 ± 1.80, and 3.69 ± 1.55, respectively. The results of the study revealed that the average VAS score in the lavender group significantly decreased compared with that of the control group ($P<.05$). The mean VAS score was higher in the control group compared with the eucalyptus group, but not to the statistically significant level ($P>.05$). The pain level of almost all participants was "mild" during needle insertion into the implantable venous port catheter (86.5% in the lavender group, 83.8% in the eucalyptus group, and 67.5% in the control group). The minority of patients (13.5% in the lavender group, 16.2% in the eucalyptus group,

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Table 1 • VAS Scores and Pain Level After Intervention in the Lavender, Eucalyptus, and Control Groups (N=123)

	Groups							
	Lavender, Mean (SD)		Eucalyptus, Mean (SD)		Control, Mean (SD)		Statistical Values	Difference[a] (Tukey Test)
VAS score	2.37±1.62		3.9±1.80		3.69±1.55		$P=.002 F=6.553$	1–3
	n	%	n	%	n	%		
Pain level								
No pain	4	9.8	1	2.4	0	0.0	$\chi^2=4.940 P=.085$	—
Mild	32	86.5	31	83.8	27	67.5		
Moderate	5	13.5	6	16.2	13	32.5		
Severe	0	0.0	3	7.3	1	2.4		

Abbreviation: VAS, visual analog scale.
[a]1, lavender group; 2, eucalyptus group; 3, control group.

and 32.5% in the control group) had a "moderate level" of pain. There was no statistical difference in pain levels among the 3 groups (Table 1).

The mean STAI-I scores of the lavender group (37.24±8.35) and the eucalyptus group (35.24±8.43) were similar to that of the control group (37.73±9.09). There was no statistically significant difference among the 3 groups ($P>.05$). In addition, the anxiety level of most participants was in the "mild level" during needle insertion into the implantable venous port catheter (65.9% in the lavender group, 75.6% in the eucalyptus group, and 61% in the control group). The remainder (34.1% of the lavender group, 24.4% of the eucalyptus group, and 39% of the control group) reported anxiety in the "moderate level." There was also no significant difference in anxiety levels among all groups (Table 2).

■ Discussion

In this study, the effect of inhalation aromatherapy was evaluated for the prevention of pain and anxiety during needle insertion into an implantable venous port catheter. The main findings of this study showed that lavender essential oil administered by inhalation decreased VAS scores during needle insertion into an implantable venous port catheter ($P<.05$). There was a significant reduction in the mean VAS score of the lavender group compared with that of the control group. Similar to the results of the current study, Kim et al[44] evaluated the effect of lavender essential oil on needle insertion–related pain in healthy volunteers and reached the conclusion that lavender oil provided a significant decrease in the pain level after the procedure in the intervention group. Another study examined the effects of lavender aromatherapy on pain after needle insertion into a fistula in patients undergoing hemodialysis. The study concluded that lavender oil provided a more significant relief in pain severity during interventions in the experimental groups.[30] Antinociceptive and analgesic properties of constituents found in the lavender essential oil are thought to be effective in reducing pain levels during procedures.

The results of the current study revealed that participants in the eucalyptus group did not show any significant decrease in VAS scores compared with the control group during needle insertion into an implantable venous port catheter ($P>.05$). Ovayolu et al[45] investigated the effect of aromatherapy massage using a mixture of sweet almond, lavender, peppermint, chamomile, jasmine, violet, rosemary, and eucalyptus oil on cancer-related pain. The study found that cancer-related pain levels were significantly reduced in the intervention group. This difference might arise from synergistic effects of these essential oils. The findings of this study revealed that eucalyptus essential oil did not have an effect on procedure-related pain in cancer patients. This finding can be interpreted to suggest that using eucalyptus essential oil alone is not indicated to be effective in reducing pain levels during procedures.

The anxiolytic effects of lavender and eucalyptus essential oils were also evaluated in this study with STAI scores. Inhalation of lavender and eucalyptus essential oils did not significantly reduce the STAI scores ($P>.05$). Similar to the results of the current study, Graham et al[11] evaluated the effect of inhalation aromatherapy using lavender, bergamot, and cedarwood oils

Table 2 • STAI-I Scores and Anxiety Level After Intervention in the Lavender, Eucalyptus, and Control Groups (N=123)

	Groups							
	Lavender, Mean (SD)		Eucalyptus, Mean (SD)		Control, Mean (SD)		Statistical Values	Difference
STAI-I score	37.24±8.35		35.24±8.43		37.73±9.09		$P=.387 F=0.956$	—
	n	%	n	%	n	%		
Anxiety level								
Mild	27	65.9	31	75.6	25	61.0	$\chi^2=2.075 P=.354$	—
Moderate	14	34.1	10	24.4	16	39.0		

Abbreviation: STAI-I, State Anxiety Inventory.

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on anxiety levels during radiotherapy and found no significant decrease in the anxiety level in the intervention group compared with the control group. In contrast, certain research studies involving placement of intrauterine devices and selective nerve root blocks found that lavender and eucalyptus oils were effective in reducing anxiety levels during the procedures.[44,46] The characteristics of the sample may have influenced the insignificant results in this study. In addition, this difference can be attributed to the stressful experience of receiving chemotherapy.

Although our study revealed that lavender essential oil administered by inhalation decreased VAS scores during needle insertion into an implantable venous port catheter; some limitations need to be noted. First, we evaluated the patients during only 1 cycle of chemotherapy, so the long-term effects are unknown. Second, cancer patients were chosen from a single hospital and included only those with implantable venous port catheters. For this reason, the results cannot be generalized to other patients.

■ Future Directions

In this study, procedural pain after needle insertion into an implantable central venous port catheter in the inhalation aromatherapy with lavender oil was significantly decreased when compared with that in patients in the control group. On the other hand, inhalation of eucalyptus oil did not reduce procedural pain levels during procedures. Lavender aromatherapy is safe, effective, inexpensive, and easy to implement as a noninvasive treatment option. Therefore, inhalation aromatherapy with lavender oil is feasible to decrease procedural pain levels during needle insertion into an implantable venous port catheter. However, further randomized controlled clinical trials are needed to validate the findings of this study.

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