Original Article

Effectiveness of Cold Application and Lavender Oil on Pain during Drain Removal: A Randomized Clinical Trial

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Abstract

Background and Aim: Analgesics are frequently used to prevent acute pain while removing the drain. Additional non-pharmacological methods have come to the agenda as a result of the fact that the pain cannot be fully controlled, and the pharmacological treatment response is variable. Our research was intended to determine the effectiveness of lavender aromatherapy and cold application in controlling pain during drain removal procedure. **Materials and Methods:** The sample of the prospective randomized controlled study consisted of 121 patients. Patient data were collected using the introductory information form and the numerical pain scale. Four groups of patients were formed (lavender oil, oxygen, cold application, control), respectively. In all groups, vital signs and pain levels were evaluated before the drain removal procedure, as soon as and 15 minutes after it was withdrawn. **Results:** Within the limits of study, lavender aromatherapy and cold application to the drainage area were found to be effective in reducing pain during drainage. When the effect on vital signs was evaluated, it was found that the pre-procedure systolic blood pressure was higher in both the lavender group and the cold application group than the post-procedure systolic blood pressure, and the respiratory rate was higher in the control group during the procedure. **Conclusions:** According to the study, it was found that applying lavender and cold application to the patients before the drainage procedure was effective in controlling pain.

Keywords: *Cold application, lavender aromatherapy, pain, surgical drain*

Introduction

It is common practice to place a drainage tube in the peritoneal cavity after abdominal surgery. Although drainage is an important intervention, the severe pain caused during the removal procedure should also be controlled.[1] In the literature, patients describe drain removal as a very painful procedure.[2] Commonly, analgesics are administered during the drain removal process to treat acute pain. Pain cannot be completely controlled with pharmacological agents, and the treatment response is variable. As a result, non-pharmacological techniques have gained prominence.[3]

Cold application is one of the nonpharmacological methods used for pain management. Cold application produces an analgesic effect by slowing the metabolism, decreasing the oxygen and nutrient needs of the tissues, relieving pressure and tension on the nerve endings by reducing inflammation, spasm, and edema, and slowing or blocking the conduction rate of the peripheral nerves. It decreases pain by increasing the release of endogenous opioids by stimulating touch receptors with the gate-control mechanism.[4-7]

Aromatherapy, where essential oils are used, is now used by many healthcare professionals as part of patient care in reducing pain and stress.[8] When researching

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the benefits of aromatherapy, it is discovered that they increase blood and lymph circulation, relieve muscle spasms, and relax the body.[8,9] According to reports, these effects of essential oils result from both skin absorption and stimulation of the sense of smell. According to the literature, the release of molecules such as dopamine, endorphins, noradrenaline, and serotonin in the brainstem is influenced by some known or unknown analgesic components in oils, and as a result, their presumed analgesic properties emerge.[8]

Aromatherapy's physiological and psychological effects are well-known in complementary medicine. This therapy has been utilized successfully in clinical settings, in the intensive care unit, for dressing change, palliative care, and relieving a wide range of pain, including labor pain control and chronic pain.[10]

Considering the physiological and psychological potential positive effect of lavender oil and the positive effect of cold application on the pain mechanism, our research is intended to determine the effectiveness of lavender aromatherapy and cold application in controlling pain during drain removal.

Materials and Methods

The prospective randomized controlled study sample consisted of 121 patients between the ages of 18–80 who underwent surgery at a training and research hospital's general surgery clinic between October and December 2021**.** Conscious patients who could speak and understand Turkish were assigned to three intervention groups and one control group**.** All patients had postoperative drain, had a stable general condition, and volunteered to participate in the study. The study excluded patients with asthma, bronchitis, chronic obstructive lung disease, contact dermatitis from cosmetic smells, pregnancy, and epilepsy.

Data collection tools

The data was gathered using a data collection form that included a Descriptive and Clinical Characteristics Form and a numerical pain scale (NPS).

Descriptive and Clinical Characteristics Form

"Descriptive and Clinical Characteristics Form" consists of 13 questions that contain the information about the patient's age, gender, educational status, body mass index (BMI), drain location, cold application time, analgesic application status before and after silicone drain removal procedure, the type of analgesic applied, the time between the last analgesic time and the time of drain removal, and the time between the drain removal time and the first analgesic application time. The Descriptive and Clinical Characteristics Form and NPS prepared were applied by the researchers with the patients before the application of NPS.

Numerical pain scale (NPS)

Black and Mattasari developed the numerical pain scale in 1993, and Tulunay and Tulunay determined its validity and reliability in Turkish in 2000. In this scale, patients are asked to quantify their pain, with 0 indicating no pain and 10 indicating intolerable pain.[11] Since it was determined that Turkish patients preferred NPS in the early postoperative period because it was simple, numeric, and easy to understand, pain intensity was determined by NPS in this study.[12]

Study process

The study protocol was approved by ClinicalTrials.gov (NCT04798040). From the data collection forms, the Descriptive and Clinical Characteristics Form was filled with the information obtained from the patient and patient file. Age, gender, educational status, BMI, pain level information was obtained from the patient. Analgesic application before and after drain removal, type of analgesic, time between drain removal time and analgesic before and after drain removal information from the patient file; cold application time, vital signs were taken by investigator observation and measurement. In accordance with the computer-generated randomization table, the patients were divided into four groups, one control group, and three intervention groups. Each intervention group comprised 30 patients, whereas the control group comprised 31.

Before the procedure, the patients who would participate in the study were explained how lavender inhalation, cold application, and oxygen application would be performed, its duration and purpose according to the group they were randomized to. They were informed that vital signs would be measured, and pain assessment would be performed before, during, and after the drain removal procedure. Before the procedure, the lavender group received 2 lt/min oxygen through an oxygen mask containing two drops of lavender oil for 15 minutes. Lavender oil was applied with a cotton swab to the inside of an oxygen face mask. Before the intervention in the cold application group, the temperature of the gel pad (-10°C) was measured with a barbecue thermometer (TB101, Mileegirl, China). Before drain removal, a gel pad was applied to the drainage area of the patients. At one-minute intervals, the patient's skin temperature was measured with an infrared non-contact thermometer (Microlife Non-Contact, Switzerland) with a wide measurement range (0–100°C) and a measurement time of three seconds. The drain was removed when the skin temperature was 13.6°C. The

oxygen group was administered 2lt/min oxygen through an oxygen mask for 15 minutes prior to the procedure. The control group was followed up according to the clinic's standard procedure; no intervention was made. In the study, blood pressure, pulse, respiratory rate, SPO2, body temperature was measured in all groups before drain removal, immediately after drain removal and 15 minutes after drain removal, and pain levels were evaluated with VAS [Figure 1].

Evaluation of data

The Statistical Package for the Social Sciences (SPSS) version 25.0 (IBM Corp., Armonk, NY, USA) program was utilized for statistical analysis when evaluating the study's findings. The study results were evaluated using descriptive statistical methods (number, percentage, median, etc.). Kolmogorov–Smirnov test was used to determine the normality distribution. To compare more than two groups, the Kruskal–Wallis test was utilized. Bonferroni correction was used to determine which groups caused the difference. The difference between two repeated measurements was calculated with the Wilcoxon test, and the difference between more than two repeated measurements was calculated with the Friedman test. The significance level was set at $P < 0.05$ for the 95 percent confidence interval.

Ethical and legal aspects of research

This research was registered by ClinicalTrials.gov (NCT04798040). Before starting the research, written permission was obtained from Clinical Research Ethics Committee (decision dated 20.01.2021 and numbered 2/IV), Traditional, Complementary and Functional Medicine Practices Clinical Research Ethics Committee (decision dated 10.09.2021 and numbered 45), Ministry of Health Services General Directorate of Traditional, Complementary and Functional Medicine Practices Department. Before the trial began, the patients were informed about the procedure of the study, the aims and objectives of the study, the risks of the procedure, the possibility of withdrawing from the study at any point without any adverse events, that their information would not be shared with anyone, and their verbal and written consent was obtained.

Results

Table 1 depicts the distribution of demographic and clinical patient characteristics. There was no statistically significant difference between the groups in terms of demographic characteristics ($P > 0.05$). There was no statistically significant difference between the study groups in terms of drainage site and analgesic

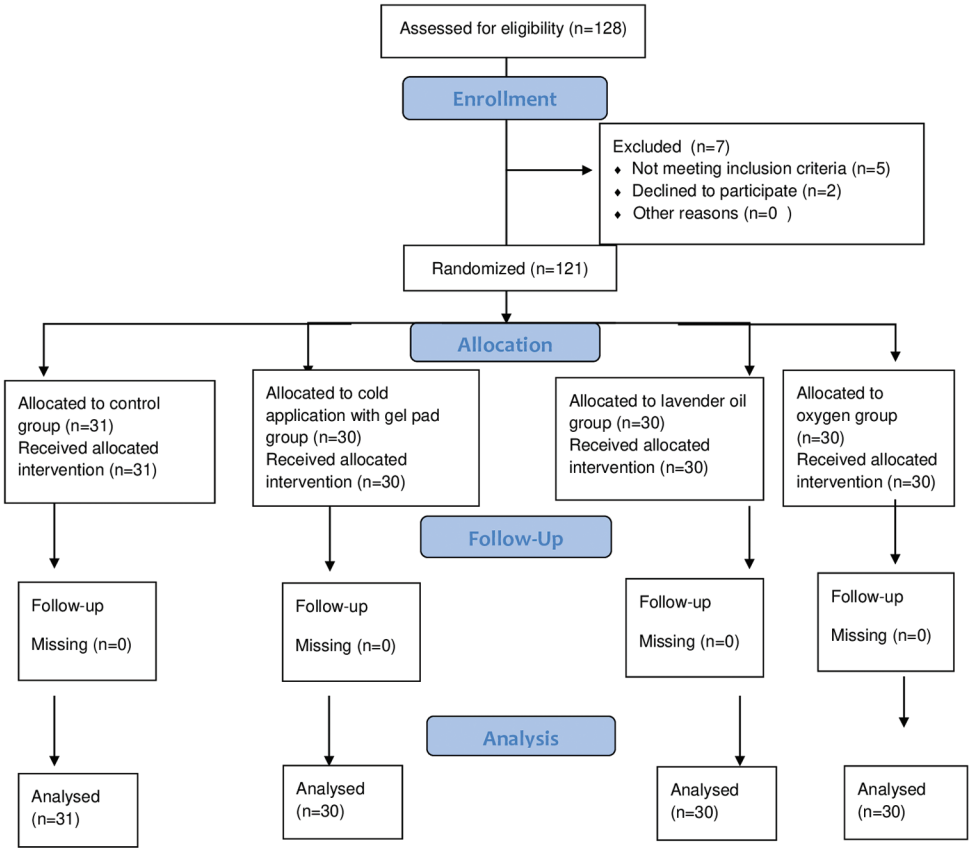

Figure 1: Consort flow diagram for this trial

Table 1: Distribution of demographic and clinical characteristics of patients (*n*=121)

Characteristics	All (*n*=121) *n* (%)	Lavender (*n*=30) *n* (%)	Oxygen (*n*=30) *n* (%)	Cold application (*n*=30) *n* (%)	Control (*n*=31) *n* (%)	χ^2/K-W	*P*
Age (Mean±SD)	58.41±12.08	54.83±12.59	57.43±10.84	59.57±13.73	61.71±10.41	6.517[b]	0.089
Gender						0.772[a]	0.856
Female	55 (45.5)	15 (50)	13 (43.3)	12 (40)	15 (48.4)		
Male	66 (54.5)	15 (50)	17 (56.7)	18 (60)	16 (51.6)		
Educational Status						6.849[a]	0.335
Primary education and below	87 (71.9)	26 (86.7)	22 (73.3)	19 (63.3)	20 (64.5)		
Secondary education	24 (19.8)	2 (6.7)	6 (20)	9 (30)	7 (22.6)		
Higher education	10 (8.3)	2 (6.7)	2 (6.7)	2 (6,7)	4 (12.9)		
Body mass index						7.162[a]	0.306
18.5-24.9	37 (30.6)	9 (30)	12 (40)	10 (33.3)	6 (19.4)		
25-29.9	51 (42.1)	12 (40)	12 (40)	15 (50)	12 (38.7)		
>30	33 (27.3)	9 (30)	6 (20)	5 (16.7)	13 (41.9)		
Drain placement						7.758[a]	0.256
GİS	51 (42.1)	9 (30)	13 (43.3)	16 (53.3)	13 (41.9)		
Cholecystectomy	40 (33.1)	13 (43.3)	6 (20)	9 (30)	12 (38.7)		
Other	30 (24.8)	8 (26.7)	11 (36.7)	5 (16.7)	6 (19.4)		
Analgesic application status before drain removal						4.751[a]	0.191
Yes	20 (16.5)	8 (26.7)	4 (13.3)	2 (6.7)	6 (19.4)		
No	101 (83.5)	22 (73.3)	26 (86.7)	28 (93.3)	25 (80.6)		
Analgesic application status after drain removal procedure						0.001[a]	1.000
Yes	4 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.2)		
No	117 (96.7)	29 (96.7)	29 (96.7)	29 (96.7)	30 (96.8)		
Time between the last analgesic time and the time of drain removal	11.03±4.25	11.57±5.81	10.86±3.31	10.69±2.99	10.97±4.41	2.604[b]	0.457

[a](χ^2)=Chi-Squared Test, [b](K-W) = Kruskal–Wallis H Test, SD=Standard deviation. P>0.05

administration ($P > 0.05$). Table 2 shows the vital signs of the patients. When the data in the table are examined;

Systolic blood pressure level was found to be statistically significantly different in lavender ($\chi2 = 6.222$, $P = 0.045$), oxygen ($\chi2 = 16.289$, $P \leq 0.001$), and cold application ($\chi2 = 6.441$, $P = 0.040$) study groups according to the time of drain withdrawal. In the subgroup analyses, this difference was found to be between the measurements before and after drain withdrawal in the lavender group ($P = 0{,}032$); between the measurements before and during drain withdrawal ($P = 0{,}011$); between the measurements during and after drain withdrawal ($P \leq 0{,}001$) in the oxygen group; between the measurements during the drain withdrawal procedure and after drain withdrawal ($P = 0{,}042$); and between the measurements during drain withdrawal and after drain withdrawal ($P = 0{,}030$) in the cold application group. There was no statistically significant difference in systolic pressure level before, during, and after drain removal in the control group ($P > 0.05$).

Diastolic blood pressure level showed a statistically significant difference according to the time of drain withdrawal only in the control group ($\chi2 = 9.571$, $P = 0.008$). In subgroup analyses, this difference was found to be between the measurements before and during drain withdrawal ($P = 0.046$), and between the measurements before and after drain withdrawal ($P = 0.007$).

The respiratory rate showed a statistically significant difference in the oxygen study group ($\chi2 = 9.645$, $P = 0.008$) and the control group ($\chi2 = 18.564$, $P \leq 0.001$) according to the time of drainage. In the subgroup analyses, this difference was found to be between the measurements before drain withdrawal and during drain withdrawal ($P = 0.007$) and between the measurements during drain withdrawal and after drain withdrawal ($P = 0.005$) in the oxygen group; similarly, between the measurements before drain withdrawal and during drain withdrawal ($P = 0.001$) and between the measurements during drain withdrawal and after drain withdrawal ($P \leq 0.001$) in the control group.

SPO_2 level was found to be statistically significantly different according to the time of drain withdrawal only in the control group ($\chi2 = 7.551$, $P = 0.023$). In the subgroup analysis, this difference was found to be between the measurements before and after drain

Table 2: Patient vital signs

Vital signs	Drain withdrawal time	Lavender (*n*=30) Mean±SD	Oxygen (*n*=30) Mean±SD	Cold application (*n*=30) Mean±SD	Control (*n*=31) Mean±SD	K-W
Systolic pressure (mmHg)	Before withdrawal[a]	124.30±16.89	124.33±17.75	124.90±17.33	123.23±26.25	0.376
	During withdrawal[b]	122.30±16.32	130.33±18.84	124.90±15.66	126.77±16.81	3.819
	After withdrawal[c]	121.33±15.85	122.33±16.75	122.07±14.09	126.45±14.50	2.887
	Friedman Test;(χ^2)/*P*	6.222/0.045*	16.289/<0.001*	6.441/0.040*	0.542/0.762	
	Difference (W) a vs b	*P*=0.170	*P*=0.011*	*P*=1.000	-	
	a vs c	*P*=0.032*	*P*=0.134	*P*=0.042*	-	
	b vs c	*P*=0.494	*P*≤0.001*	*P*=0.030*	-	
Diastolic pressure (mmHg)	Before withdrawal[a]	82.77±8.90	77.67±10.40	80.70±8.64	80.65±6.80	4.038
	During withdrawal[b]	81.50±7.85	80.67±12.85	81.93±8.97	78.06±7.03	4.723
	After withdrawal[c]	80.17±8.15	77.33±10.48	80.37±7.14	76.77±5.41	5.324
	Friedman Test;(χ^2)/*P*	4.141/0.126	5.746/0.057	0.326/0.850	9.571/0.008*	
	Difference (W) a vs b	-	-	-	*P*=0.046*	
	a vs c	-	-	-	*P*=0.007*	
	b vs c	-	-	-	*P*=0.157	
Pulse (rate/minute)	Before withdrawal[a]	82.90±15.48	87.17±13.85	88.13±10.86	85.10±13.04	1.498
	During withdrawal[b]	83.17±14.36	87.67±11.74	88.83±10.47	82.13±10.43	4.376
	After withdrawal[c]	83.53±12.93	85.80±12.94	86.53±12.85	82.71±11.63	1.161
	Friedman Test;(χ^2)/*P*	2.914/0.233	1.345/0.510	1.126/0.569	3.267/0.195	
Respiratory rate (rate/minute)	Before withdrawal[a]	18.67±2.51	18.27±2.64	19.27±2.02	18.32±2.56	4.451
	During withdrawal[b]	19.20±2.07	19.60±2.77	18.70±1.62v	20.06±2.05	6.605
	After withdrawal[c]	18.70±2.52	18.43±2.82	19.13±2.21	18.55±2.05	2.633
	Friedman Test;(χ^2)/*P*	1.820/0.403	9.645/0.008*	1.000/0.607	18.564/<0.001*	
	Difference (W) a vs b	-	*P*=0.007*	-	*P*=0.001*	
	a vs c	-	*P*=0.535	-	*P*=0.212	
	b vs c	-	*P*=0.005*	-	*P*=<0.001*	
SPO_2	Before withdrawal[a]	96.63±1.83	96.37±4.30	95.90±4.93	95.52±2.78	8.731
	During withdrawal[b]	97.00±1.51	96.23±4.42	96.03±4.73	95.74±4.04	3.608
	After withdrawal[c]	91.60±19.79	96.20±4.26	95.97±4.86	96.32±2.50	1.789
	Friedman Test;(χ^2)/*P*	1.121/0.571	0.602/0.740	1.342/0.511	7.551/0.023*	
	Difference (W) a vs b	-	-	-	*P*=0.357	
	a vs c	-	-	-	*P*=0.002*	
	b vs c	-	-	-	*P*=0.115	
Body temperature (^{0}C)	Before withdrawal[a]	36.77±0.32	36.92±0.43	36.76±0.32	36.72±0.35	2.658
	During withdrawal[b]	36.76±0.30	37.00±0.51	36.79±0.33	36.70±0.28	6.698
	After withdrawal[c]	36.84±0.27	36.96±0.49	36.79±0.33	36.69±0.32	6.582
	Friedman Test;(χ^2)/*P*	4.361/0.113	5.711/0.058	4.900/0.086	3.509/0.173	

χ^2=Friedman Test, K-W=Kruskal–Wallis H Test, W=Wilcoxon test, SD=Standard deviation. *=*P*<0.05. a: before withdrawal; b: during withdrawal; c: after withdrawal

withdrawal (P = 0.002). In addition, SPO_2 level before drain withdrawal was found to differ between the research groups (K-W = 8,731, P = 0,033); according to the Bonferroni correction analysis, this difference was found to be between the oxygen study group and the control group.

Table 3 shows the pain scores of the patients. When the data in the table are examined,

It was found that the pain level before drain withdrawal differed between the study groups (K-W = 11.730, P = 0.008). According to the Bonferroni correction analysis, this difference was found to be between the cold application group and the control group. From this finding, it was seen that the pain level was higher in the cold application group before drain withdrawal.

It was found that the pain level during the drain withdrawal procedure differed between the study groups (K-W = 55.030, $P \leq 0.001$). According to the Bonferroni correction analysis, this difference was found to be between lavender group and oxygen and control group and between cold application group and oxygen and control group. From these findings, it was seen

Table 3: Patient pain scores

		Drain withdrawal time					
Intervention	**Statistical descriptors**	**Before withdrawal[e]**	**During withdrawal[f]**	**After withdrawal[g]**	**Friedman Test;(χ^2)**	***P***	***W***
Lavender[a] (*n*=30)	Mean±SD	3.33±1.90	1.27±1.41	0.33±0.55	46.340	<0.001*	e vs f
	Median	3	1	0			e vs g
	Range	0-7	0-4	0-2			f vs g
Oxygen[b] (*n*=30)	Mean±SD	2.83±2.20	4.00±2.39	1.03±1.61	30.660	<0.001*	e vs f
	Median	3	4	0			e vs g
	Range	0-8	0-10	0-6			f vs g
Cold application[c] (*n*=30)	Mean±SD	3.77±1.52	0.73±1.05	0.23±0.43	55.861	<0.001*	e vs f
	Median	3,5	0	0			e vs g
	Range	1-7	0-3	0-1			f vs g
Control[d] (*n*=31)	Mean±SD	2.16±2.10	4.42±2.67	1.13±1.18	45.125	<0.001*	e vs f
	Median	2	4	1			e vs g
	Range	0-8	1-10	0-4			f vs g
	K-W/*P*	11.730/0.008*	55.030/<0.001*	13.623/0.003*			
Bonferroni correction	a vs b	*P*=1.000	*P*≤0.001*	*P*=0.856			
	a vs c	*P*=1.000	*P*=1.000	*P*=1.000			
	a vs d	*P*=0.087	*P*≤0.001*	*P*=0.029*			
	b vs c	*P*=0.514	*P*≤0.001*	*P*=0.295			
	b vs d	*P*=0.767	*P*=1.000	*P*=1.000			
	c vs d	*P*=0.007*	*P*≤0.001*	*P*=0.005*			

a: Lavender group; b: Oxygen group; c: Cold application group; d: Control group; e: Before withdrawal; f: During withdrawal; g: After withdrawal

that the highest pain level during the drain withdrawal procedure was in the control group.

It was found that the pain level after drain withdrawal differed between the study groups (K-W = 13.623, *P* = 0.003). According to the Bonferroni correction analysis, this difference was found to be between the control group and lavender and cold application group. From these findings, it was seen that the highest pain level after the drain withdrawal procedure was in the control group.

Discussion

There was no statistically significant difference between the groups when patients were investigated according to demographic parameters ($P > 0.05$). This shows that the groups are homogeneous.

Pain is a multidimensional subjective emotion that can be affected by physiological, sensory, emotional, cognitive, behavioral, and sociocultural elements. In the scope of our study, lavender aromatherapy and cold application to the drainage area were found to be effective in reducing pain during drainage. When the effect on vital signs was evaluated, it was discovered that the pre-procedure systolic blood pressure was higher in both the lavender group and the cold application group than the post-procedure systolic blood pressure, and that the control group had a higher respiratory rate during the procedure. The change in systolic blood pressure in the intervention groups suggests that the applications are effective in stimulating the parasympathetic system by showing the expected effect in the neuroendocrine response with the decrease in pain, and the number of breaths in the control group increases due to the stimulation of the sympathetic nervous system with the sensation of pain.

In a study conducted on patients undergoing mechanical ventilation, lavender oil aromatherapy was found to be effective on SPO_2 levels.[13] It was determined that 10 minutes of lavender oil inhalation after open heart surgery did not significantly alter the SPO2 level 30 minutes after the procedure.[14] While there were no significant differences between the intervention groups, patients in the control group had a lower SPO2 level prior to drain extraction. Based on this result, it is hypothesized that the pain experienced by patients due to the presence of drains prevents breathing and decreases SPO2 levels.

Salamati *et al*. found a significant decrease in pulse 30 minutes after 10 minutes of lavender oil inhalation.[14] In a separate study, measurements taken on the second and third post-surgery days after lavender oil aromatherapy application for 20 minutes revealed no significant differences between groups. However, while the pulse rate of patients in the control group increased during all measurements, the pulse rate of patients in

the study group was found to be lower at 60 minutes after inhalation than at five and thirty minutes after inhalation.[15] In our study, the number of pulses was greater in the lavender group in the post-procedure period compared to the pre-procedure period, while it was lower in the other groups. These results lack statistical significance.

In a study, it was observed that lavender oil aromatherapy had no effect on respiratory rate in patients with open heart surgery.[15] Salamati *et al*. found that lavender oil aromatherapy decreased respiratory rate after open heart surgery, but the change was not significant.[14] After the procedure, the respiratory rate decreased in the lavender group and increased in the cold application group, but the difference was not statistically significant. The oxygen group had a significantly lower respiratory rate before and after the procedure, while the control group had a significantly higher respiratory rate during the procedure. This difference was statistically significant. Although there was no statistically significant difference between the groups based on simultaneous measurements, the decrease in respiratory rate in the intervention groups can be attributed to the patients' psychological relaxation.

Due to the neuroendocrine response, pain increases the release of catecholamine and catabolic hormones, decreases the release of anabolic hormones, and causes sodium and water retention, leading to an increase in blood pressure. In their study, Ebrahimi *et al*.(2018) found that lavender oil aromatherapy significantly lowered systolic blood pressure on the second day following open heart surgery.[16] In a similar vein, Mashouf *et al*.(2017) found that the systolic blood pressure of patients undergoing mechanical ventilation decreased.[14] Lytle *et al*.(2014) found a significant reduction in systolic blood pressure levels in intensive care unit patients following lavender oil aromatherapy.[17] In our study, it was determined that the postoperative systolic blood pressure was significantly reduced in the lavender, oxygen, and cold application groups. As pain decreases, the sympathetic nervous system becomes less active in the body. Consequently, we hypothesize that the parasympathetic effect in the cardiovascular system lowers systolic blood pressure.

According to the studies, aromatherapy with lavender oil is effective for lowering diastolic blood pressure.[13,14] Patients in the control group experienced a significant decrease in diastolic blood pressure during and after the procedure, whereas there was no significant change in the intervention groups. Like the reduction in systolic blood pressure, the reduction in diastolic blood pressure can be attributed to a reduction in sympathetic stimuli. Due to the high level of pain in the control group, it is anticipated that the sympathetic system will be more active, resulting in a higher diastolic blood pressure. In our study, the change in diastolic blood pressure in the control group can be attributed to the patients' unique characteristics.

It has been suggested that volatile oils can alleviate perioperative anxiety and pain in patients admitted to intensive care units and awaiting outpatient surgery, as well as in patients undergoing cesarean section and coronary artery bypass grafting.[10,14,18-25] In one study, lavender oil had no effect on the pain of breast biopsy patients.[10] Salamati *et al*. found that although they showed similar findings when evaluating the benefits of lavender oil, lavender oil didn't provide an objective, measurable benefit.[14]

In a study, lavender oil was applied to hemodialysis patients by inhalation before needle insertion into the fistula, and lavender was found to be significantly effective in reducing pain level.[26] Again, in the trial involving patients who will have a preoperative peripheral venous catheter, it was discovered that applying inhaled lavender oil to patients prior to the treatment dramatically reduced pain.[27] Lavender oil inhalation can be utilized as part of a multimodal pain treatment after cesarean section, but it is not sufficient alone, according to a study.[25] Ghods *et al*. concluded in a similar trial that lavender oil aromatherapy could help patients with pain.[28] Our study is generally compatible with the literature. Unlike findings in some studies, the effectiveness of lavender oil aromatherapy may be affected by keeping the inhalation time longer in our study. It is thought that analgesic effect is observed, and pain levels of patients decrease due to neurotransmitters in lavender oil.

According to studies on the effect of cold application on pain during chest tube removal, cold application is effective in pain control, and pain decreases over time.[1,4,5,29,30] In a study, it was determined that cold application did not have a statistically significant effect on chest tube removal-induced pain, but it did reduce pain.[6] In accordance with numerous previous studies, we found that cold application is effective for pain management. Although there was no statistically significant difference between lavender inhalation and cold application for pain control, the pain level was lower in the cold application group.

Our study is limited by the fact that the patient groups consist exclusively of those with postoperative drainage. This restriction will hinder the generalizability of the

findings and increase the homogeneity of the study population. This study was conducted with an open-label design because the nature of the interventions precluded the design of a placebo.

Conclusion

As a result, the current randomized controlled study suggests that cold application and lavender oil inhalation during the drain withdrawal of aromatherapy can be used as non-pharmacological pain treatments. Given the ease of implementation and cost-effectiveness of such approaches, their use in clinical practice may be recommended to medical professionals. Before routine application; however, it is recommended to confirm the current findings with larger-scale studies.

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Conflicts of interest

There are no conflicts of interest.

References

1. Demir Y, Khorshid L. The effect of cold application in combination with standard analgesic administration on pain and anxiety during chest tube removal: A single-blinded, randomized, double-controlled study. Pain Manag Nurs 2010;11:186-96.
2. Tucci G, Amorese V, Romanini E. Closed suction drainage after orthopaedic surgery: Evidence versus practice. J Orthop Traumatol 2006;7:29-32. doi: 10.1007/s10195-006-0118-9.
3. Hood BS, Henderson W, Pasero C. Chest tube removal: An expanded role for the bedside nurse. J Perianesth Nurs 2014;29:53-9. doi: 10.1016/j.jopan.2013.11.001.
4. Ertuğ N, Ulker S. The effect of cold application on pain due to chest tube removal. J Clin Nurs 2012;21:784-90.
5. Gorji HM, Nesami BM, Ayyasi M, Ghafari R, Yazdani J. Comparison of ice packs application and relaxation therapy in pain reduction during chest tube removal following cardiac surgery. N Am J Med Sci 2014;6:19-24. doi: 10.4103/1947-2714.125857.
6. Hsieh LY, Chen YR, Lu MC. Efficacy of cold application on pain during chest tube removal: A randomized controlled trial: A CONSORT-compliant article. Medicine (Baltimore) 2017;96:e8642. doi: 10.1097/MD.0000000000008642.
7. Özveren H. Ağrı kontrolünde farmakolojik olmayan yöntemler. Hacettepe Üniversitesi Hemşirelik Fakültesi Derg 2011;18:83-92.
8. Gül A, Eti Aslan F. Ağrı Kontrolüne Kanıt Temelli Yaklaşım; Masaj ve Aromaterapi. Turkiye Klin J Nurs Sci 2012;4:30-6.
9. Steflitsch W, Steflitsch M. Clinical aromatherapy. J Mens Health 2008;5:74-85. doi: 10.1016/j.jomh. 2007.11.001.
10. Kim JT, Ren CJ, Fielding GA, Pitti A, Kasumi T, Wajda M, *et al*. Treatment with lavender aromatherapy in the post-anesthesia care unit reduces opioid requirements of morbidly obese patients undergoing laparoscopic adjustable gastric banding. Obes Surg 2007;17:920-5.
11. Tulunay M, Tulunay, F C. Ağrının Değerlendirilmesi ve Ağrı Ölçümleri. In: Erdine S, ed. Ağrı. İstanbul: Nobel Tıp Kitabevleri; 2000:91-107.
12. Yazici Sayin Y, Akyolcu N. Comparison of pain scale preferences and pain intensity according to pain scales among Turkish patients: A descriptive study. Pain Manag Nurs 2014;15:156-64.
13. Mashouf S, Aflaki M, Zanjani SSE, Mojab F. The effects of aromatherapy by lavender oil on agitation and hemodynamic parameters in mechanically ventilated patients in ICU. Tradit Integr Med 2017;2:119-28. http://jtim.tums.ac.ir/index.php/jtim/article/view/102.
14. Salamati A, Mashouf S, Mojab F. Effect of inhalation of lavender essential oil on vital signs in open heart surgery ICU. Iran J Pharm Res 2017;16:404-9.
15. Bikmoradi A, Seifi Z, Poorolajal J, Araghchian M, Safiaryan R, Oshvandi K. Effect of inhalation aromatherapy with lavender essential oil on stress and vital signs in patients undergoing coronary artery bypass surgery: A single-blinded randomized clinical trial. Complement Ther Med 2015;23:331-8.
16. Ebrahimi Hosein Abadi S, Paryad E, Ghanbari Khanghah A, Pasdaran A, Kazem Nezhad Leyli E, Sadeghi Meibodi A. Effects of aromatherapy using lavender oil on hemodynamic indices after coronary artery bypass graft surgery. J Holist Nurs Midwifery 2018;28:163-70.
17. Lytle J, Mwatha C, Davis KK. Effect of lavender aromatherapy on vital signs and perceived quality of sleep in the intermediate care unit: A pilot study. Am J Crit Care 2014;23:24-9. doi: 10.4037/ajcc2014958.
18. Braden R, Reichow S, Halm MA. The use of the essential oil lavandin to reduce preoperative anxiety in surgical patients. J Perianesth Nurs 2009;24:348-55. doi: 10.1016/j.jopan. 2009.10.002.
19. Cho EH, Lee MY, Hur MH. The effects of aromatherapy on intensive care unit patients' stress and sleep quality: A nonrandomised controlled trial. Evid Based Complement Alternat Med 2017;2017:2856592.
20. Fayazi S, Babashahi M, Rezaei M. The effect of inhalation aromatherapy on anxiety level of the patients in preoperative period. Iran J Nurs Midwifery Res 2011;16:278-83.
21. Heidari Gorji MA, Ashrastaghi OG, Habibi V, Charati JY, Ebrahimzadeh MA, Ayasi M. The effectiveness of lavender essence on strernotomy related pain intensity after coronary artery bypass grafting. Adv Biomed Res 2015;4:127.
22. Karadag E, Samancioglu S, Ozden D, Bakir E. Effects of aromatherapy on sleep quality and anxiety of patients. Nurs Crit Care 2017;22:105-12.
23. Kritsidima M, Newton T, Asimakopoulou K. The effects of lavender scent on dental patient anxiety levels: A cluster randomised-controlled trial. Community Dent Oral Epidemiol 2010;38:83-7.
24. Ni CH, Hou WH, Kao CC, Chang ML, Yu LF, Wu CC, *et al*. The anxiolytic effect of aromatherapy on patients awaiting ambulatory surgery: A randomized controlled trial. Evid Based Complement Alternat Med 2013;2013:927419.
25. Olapour A, Behaeen K, Akhondzadeh R, Soltani F, Al Sadat Razavi F, Bekhradi R. The effect of inhalation of aromatherapy blend containing lavender essential oil on cesarean postoperative pain. Anesth Pain Med 2013;3:203-7. doi: 10.5812/aapm. 9570.
26. Bagheri-Nesami M, Espahbodi F, Nikkhah A, Shorofi SA, Charati JY. The effects of lavender aromatherapy on pain following needle insertion into a fistula in hemodialysis patients. Complement Ther Clin Pract 2014;20:1-4.
27. Karaman T, Karaman S, Dogru S, Tapar H, Sahin A, Suren M,

et al. Evaluating the efficacy of lavender aromatherapy on peripheral venous cannulation pain and anxiety: A prospective, randomized study. Complement Ther Clin Pract 2016;23:64-8. doi: 10.1016/j.ctcp.2016.03.008.

28. Ghods AA, Abforosh NH, Ghorbani R, Asgari MR. The effect of topical application of lavender essential oil on the intensity of pain caused by the insertion of dialysis needles in hemodialysis patients: A randomized clinical trial. Complement Ther Med 2015;23:325-30.
29. Hasanzadeh F, Kashouk NM, Amini S, Asili J, Emami SA, Vashani HB, *et al*. The effect of cold application and lavender oil inhalation in cardiac surgery patients undergoing chest tube removal. EXCLI J 2016;15:64-74. doi: 10.17179/excli2015-748.
30. Soydan D, Uğraş GA. Effect of different cold application materials on pain during chest tube removal: Three-arm randomized controlled clinical trial. Afr Health Sci 2021;21:1273-81. doi: 10.4314/ahs.v21i3.38.