Original Article

The effect of lavender essential oil on anxiety level in patients undergoing coronary artery bypass graft surgery: A double-blinded randomized clinical trial

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Abstract

Background: Open heart surgery can cause high levels of anxiety in patients. Nowadays, lavender essential oil is widely used in medical research. This study was conducted with an aim to investigate the effects of lavender essential oil to reduce the anxiety of patients after coronary artery bypass surgery.

Materials and Methods: This research is double-blinded randomized controlled trial on 60 patients who had undergone coronary artery bypass surgery in a 2-day intervention targeting reduction of anxiety. This study was conducted in Ekbatan Therapeutic and Educational Center, Hamadan city, Iran, in 2013. The patients in the inhalation aromatherapy group inhaled two drops of 2% lavender essential oil and those in the control group inhaled two drops of distilled water as placebo for 20 min on the 2nd and 3rd days after surgery. The level of anxiety was evaluated by Spielberger's State Anxiety questionnaire before and after intervention and the vital signs were documented as well. Data were analyzed using Stata 11 (Stata Corp., College Station, TX, USA) by independent *t*-test for continuous variables and Chi-square test for categorical variables.

Results: The mean score of anxiety in the aromatherapy group was 48.73 ± 5.08 and in the control group was 48 ± 6.98 before the intervention (P = 0.64), which reduced after the intervention to 42.6 ± 5.44 and 42.73 ± 7.30, respectively. On the 3rd day after surgery, the mean score of anxiety in the aromatherapy group was 46.76 ± 4.07 and in the control group was 46.53 ± 7.05 before the intervention, which reduced to 41.33 ± 3.65 and 41.56 ± 6.18, respectively, after the intervention. However, there was no statistically significant difference in the mean scores of anxiety between the aromatherapy and control groups.

Conclusions: Lavender essential oil has no significant effect on anxiety in patients after coronary artery bypass surgery, although it decreased the level of anxiety in the patients.

Key words: Anxiety, aromatherapy, coronary artery bypass, Iran, plant medical

Introduction

Coronary artery bypass graft (CABG) surgery is a common form of treatment for patients with coronary stenosis and more than 73 million surgeries are performed annually only in the United States.[1] Despite achieving technical success for most patients, clinically significant morbidities such as cardiologic shock, dysrhythmia, gastrointestinal bleeding, pain, anxiety, and vital sign changes are common.[2-4]

CABG is reported to be associated with pre- and postoperative anxiety and may impair the coronary circulation and, hence, increase the risk of angina pectoris and myocardial infarction.[5] In one of the studies, the prevalence of anxiety after open heart surgery in patients has been reported to be 24.7%.[6] There are a number of factors that may increase anxiety in patients admitted in the intensive care unit (ICU), including pain, sleep disorder, absence from home and work, long-term treatment and disease, economic problems, and lack of social support such as insurance, family and social problems[7,8] Anxiety can cause tachypnea, increased blood pressure, hypothermia, arterial vasoconstriction, and decreased tissue perfusion through stimulation of the sympathetic response.[9] Anxiety is a considerable challenge that can indirectly increase postoperative pain and analgesic usage, decrease

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resistance against infection, prolong postoperative wound healing,[10] and increase the duration of hospitalization.[11] Sedative medications are frequently used to decrease anxiety among patients who had undergone CABG, which is usually associated with adverse effects such as sedation and respiratory depression.[12]

Complementary and alternative medicine (CAM) therapies are safer than pharmacologic approaches and have less adverse effects. Aromatherapy is a natural treatment method that utilizes the chemical structure and effects of essential oils. It can be applied in various forms such as massage, inhalation, compress, and baths with herbal and mineral substances. Use of aromatherapy has grown substantially in recent years compared to other medical approaches.[13,14] Inhalation aromatherapy is a technique in which essential oils are used in inhalation,[15] which can decrease pain, anxiety, depression, and improve the vital signs.[16-18]

Lavender is one such plant that is widely used in aromatherapy, with aromatic leaves and attractive bracts at the top of flowers. Some of its effects are sedative, antidepressant, antispasmodic, antibacterial, and local anesthetic. It also can be used in relieving migraines and insomnia.[19,20] Studies about the benefits of lavender's aroma showed that linalool and linalyl acetate present in this plant can stimulate parasympathetic system. In addition, linalyl acetate has narcotic effects and linalool acts as a sedative.[13,21] This herb improves the heart function and as a circulatory stimulant, it has beneficial effects on coronary blood flow.[5] Studies have shown that inhalation of lavender aromatherapy is effective in reducing depression, pain, and anxiety in women undergoing cesarean section and in patients undergoing dental procedures or abdominal surgery.[13,17,22]

CABG is a relatively common procedure for treatment of coronary stenosis. It is usually a stressful event for patients,[23] indicating the importance of anxiety reduction strategies and stable vital signs in them. The intensive care nurses have an important role in assessment of anxiety and changes in vital signs, implementation of appropriate measures, and evaluation of therapeutic effects. Accordingly, this study was carried out with an aim to investigate the effects of inhalation aromatherapy using lavender oil to reduce anxiety in patients after CABG.

Materials and Methods

A double-blinded randomized controlled trial was conducted on 60 patients who had undergone CABG in Ekbatan Therapeutic and Educational Center, Hamadan city, Iran. The entire study process was approved by the Research Ethics Committee of Hamadan University of Medical Sciences, and the protocol was registered by Iranian Registry of Clinical Trials (No.: 201203299014N9).

The details of the study were explained to the participants and their informed consent was obtained in writing. In order to avoid inductive effect of the medication, both patients and interviewers were unaware of the treatment each patient had received. For this purpose, the medications were given to the patients by one researcher and the effect of treatments was evaluated by another researcher independently.

The inclusion criteria included the absence of (a) chronic respiratory disease, (b) addiction to alcohol or narcotic substances, (c) history of head trauma or convulsion, (d) impaired sense of smell, (e) using anti-anxiety drugs, and (f) acute mental illness according to physician diagnosis and obtaining a score of less than 20 with Spielberger's questionnaire. Patients were excluded if they had (a) eczema or allergy to plants, (b) impaired consciousness, (c) been intubated for more than 24 h, (d) hemodynamic instability, and (e) severe acute pain at the time of completing the questionnaire.

Randomization

The eligible patients were randomly assigned to the aromatherapy and control groups using balanced block randomization with a block size of four. For this purpose, the aromatherapy and control groups were randomly assigned to letters A and B. Thus, for each block of four patients, two sequence different assignments were made for each treatment. Six sheets of paper were used. In the papers were written all the possible states, i.e. Paper No. 1 for AABB, Paper No. 2 for ABAB, Paper No. 3 for ABBA, Paper No. 4 for BBAA, Paper No. 5 forBABA, and Paper No. 6 or BAAB. Then the number were selected randomly via table of random numbers. According to number of selected papers, the patients respectively were in the aromatherapy or control groups.

Allocation

Participants ($N = 70$) were randomly assigned to two groups: Aromatherapy ($n = 35$) and control group ($n = 35$). Follow-up of patients was lost in the aromatherapy ($n = 3$) and control groups ($n = 4$) due to them getting discharged on the 3rd day after surgery. Intervention was discontinued in the aromatherapy group ($n = 2$) due to intolerance of aromatherapy and in the control group ($n = 1$) due to lack of cooperation. Thus, in each of the aromatherapy and control groups, $n = 30$ were analyzed.

Data collection was based on completing the questionnaire, interviewing, and recording the vital signs. The data collection tool included a questionnaire with two parts

and a checklist of items. The first part of the questionnaire contained demographic information such as age, gender, body mass index (BMI), educational level, and marital status. Additional information obtained included history of hospitalization or open heart surgery in the family, as well as the duration of operation and admission in the ICU. For assessing the scientific validity of this part of the questionnaire, content validity was used.

The second part of the questionnaire consisted of the standard questionnaire of Spielberger. It included 20 questions related to the State Trait Anxiety Inventory (STAI). The least score of 20 that could be obtained indicated no anxiety and the maximum score of 80 illustrated the highest level of anxiety. A score of 21-39 indicated mild anxiety. A score of 40-59 indicated moderate anxiety, and a score of 60-80 indicated severe anxiety.[13] This questionnaire enjoys universal validity and reliability. Its reliability had already been confirmed on 600 people in Mashhad and the Cronbach's alpha coefficient obtained was 0.94 in the norm population. This questionnaire has been used in local and international studies widely.[24] The checklist of items was used to recode vital signs such as systolic and diastolic blood pressure, heart and respiratory rates, and temperature measured by a monitoring machine manufactured by Sairan Co. Iran.

Based on a single-blind clinical trial conducted in 2011 by Hadi *et al.*,[25] the sample size needed in our study was estimated to be 30 subjects in each arm (totally 60) with *P* at 0.05 and 90% power. There were 30 subjects in the aromatherapy group and 30 subjects in the control group, who contributed data to the study according to the trial profile [Figure 1]. The eligible patients were randomly assigned to the aromatherapy and control groups using balanced block randomization with a block size of four.

The patients in the aromatherapy group inhaled two drops of 2% lavender essential oil, produced by Barij Esans Co. Iran (kashan), via an absorbable patch connected inside an oxygen mask for 20 min[26] on the 2nd and 3rd days[27] after surgery. The patients in the control group received two drops of distilled water as placebo via an oxygen mask at the same time as the aromatherapy group. On the 2nd and the 3rd days after surgery, in the aromatherapy and control groups, anxiety was measured before and 20 min after the intervention[28] using Spielberger's questionnaire. Vital signs including heart rate, respiratory rate, and systolic and diastolic blood pressure were measured before the intervention and then at 5th, 30th, and 60th minute after the intervention[23,29] by a monitoring machine.

All statistical analyses were performed at a confidence level of 0.05 using the statistical software Stata 11 (Stata Corp., College Station, TX, USA). The relationship between the dependent and independent variables was investigated using independent statistical *t*-test for continuous variables and Chi-square test for categorical variables.

Results

Table 1 shows the distribution of individual characteristics of the patients in aromatherapy and control groups. Majority of patients in the aromatherapy group (n = 19) and the control group (n = 23) were males and the rest females. The mean age in the aromatherapy group

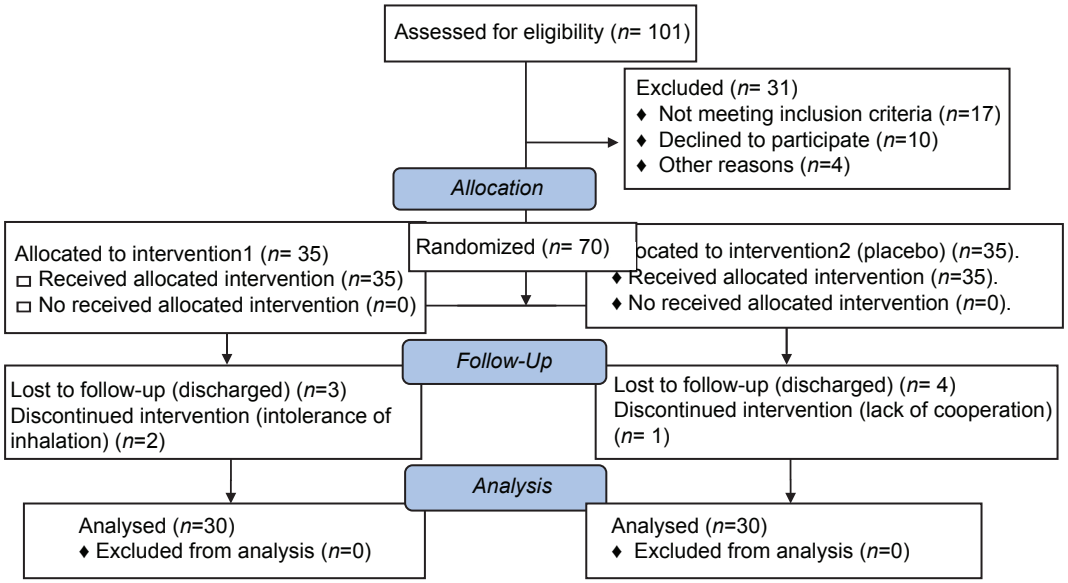

Figure 1: Trial profile

was 65.13 ± 9.76 years and in the control group was 65.63 ± 10.80 years. According to the results presented in the table, there was no statistically significant difference between the aromatherapy and control groups regarding the individual characteristics that might have an effect on the treatment.

Table 1: Distribution of individual characteristics of the patients in aromatherapy (lavender) and control (placebo) groups

Variables	Control group	Aromatherapy group	*P* value
Gender			0.260
Male	23	19	
Female	7	11	
Marital status			0.131
Single	0	1	
Married	27	29	
Widow	3	0	
Education			0.075
Illiterate	25	25	
Secondary	4	3	
Highly	1	2	
History of hospitalization			0.317
Yes	7	4	
No	23	26	
Family history of cardiac surgery			0.665
Yes	3	3	
No	27	27	
Age (years)			0.852
Mean (±SD)	65.63 (±10.81)	65.13 (±9.76)	
Body mass index			0.202
Mean (±SD)	25.32 (±3.43)	2650 (±3.67)	
Days of hospitalization			0.573
Mean (±SD)	3.3 (±0.65)	3.27 (±0.74)	

SD: Standard deviation

Table 2: Comparison of the mean difference of anxiety among the intervention (lavender) and control (placebo) groups according to Spielberger's questionnaire using independent *t*-test

The day after surgery	Control		Aromatherapy		Difference		*P* value
	Mean	SD	Mean	SD	Mean	SE	
2nd day							
Before intervention	48	6.98	48.73	5.08	0.73	1.57	0.643
After intervention	42.73	7.30	42.6	5.44	0.13	1.66	0.936
3rd day							
Before intervention	46.53	7.05	46.77	4.07	0.23	1.49	0.875
After intervention	41.57	6.18	41.33	3.65	0.23	1.31	0.859

SD: Standard deviation; SE: Standard error

Table 2 shows the mean score of anxiety based on the Spielberger's questionnaire On the 2nd day after surgery, the mean score of anxiety before intervention in the aromatherapy group was 48.73 ± 5.08 and in the control group was 48 ± 6.98, which reduced after the intervention to 42.6 ± 5.44 and 42.73 ± 7.30, respectively ($P = 0.541$). On the 3rd day after surgery, the mean score of anxiety before intervention in the aromatherapy group was 46.76 ± 4.07 and in the control group was 46.53 ± 7.05, which reduced after the intervention to 41.33 ± 3.65 and 41.56 ± 6.18, respectively ($P = 0.672$). However, the mean score of anxiety decreased significantly after surgery in both groups ($P = 0.032$, $P = 0.036$), but the difference between aromatherapy and control groups before and after intervention was significant neither on the 2nd day ($P = 0.36$) nor on the 3rd day ($P = 0.41$) after surgery

Table 3 shows the changes in vital signs of the patients in aromatherapy and control groups before the intervention and at 5th, 30th, and 60th minute after the intervention on the 2nd and 3rd days after surgery. There was no statistically significant difference in the vital signs ($P = 0.06$), except in the systolic blood pressure ($P = 0.004$), between the aromatherapy and control groups either on the 2nd day or on the 3rd day after surgery.

Discussion

Some studies have reported that the level of anxiety is different between males and females. Nonetheless, we did not find any significant difference in the mean score of anxiety between the two sexes. Furthermore, we found no relationship between educational level and anxiety. Dehdari *et al.* reported similar results.[30]

Open heart surgery is a stressful approach. Several studies have reported that patients who had undergone CABG suffer from anxiety after surgery.[7,31] We found that patients had moderate anxiety before the intervention in both aromatherapy and control groups. However, their anxiety deceased significantly after the intervention, although no statistically significant difference was observed between the two groups. One possible reason for this is that pain and other reasons of stress like fear of surgery and anesthesia had been resolved. Fear and anxiety of the future health status may remain after surgery which may affect the mental health status.

Rymazewska *et al.*[32] reported that patients who are candidates for CABG have severe anxiety before surgery, but their anxiety decreases considerably a few days after surgery and increases gradually 3 months thereafter.

Table 3: Comparison of the mean difference in homodynamic measurements in intervention (lavender) and control (placebo) groups using independent *t*-test

Mean difference compared to baseline	Control		Aromatherapy		Difference		*P* value
	Mean	SD	Mean	SD	Mean	SE	
Temperature (°C) on the 2nd day							
After 5 min	0.007	0.037	0.003	0.018	0.003	0.007	0.656
After 30 min	0.003	0.081	0.003	0.130	0.001	0.028	1.000
After 60 min	0.173	0.923	0.127	0.427	0.047	0.123	0.707
Temperature (°C) on the 3rd day							
After 5 min	0.030	0.226	0.003	0.041	0.033	0.042	0.430
After 30 min	0.057	0.265	0.010	0.066	0.047	0.050	0.353
After 60 min	0.227	0.385	0.040	0.679	0.187	0.143	0.195
Respiratory rate (breaths/min) on the 2nd day							
After 5 min	0.200	6.424	1.400	8.517	1.200	1.948	0.540
After 30 min	0.233	7.745	0.700	10.195	0.467	2.337	0.843
After 60 min	2.500	9.108	1.100	6.451	3.600	2.038	0.083
Respiratory rate (breaths/min) on the 3rd day							
After 5 min	0.467	6.334	1.367	8.381	0.009	1.918	0.641
After 30 min	0.700	6.314	0.600	6.078	0.100	1.600	0.950
After 60 min	0.300	8.238	0.933	6.091	1.233	1.871	0.912
Heart rate (beats/min) on the 2nd day							
After 5 min	1.467	5.532	1.067	5.589	0.400	1.436	0.782
After 30 min	0.067	7.460	0.667	6.461	0.733	1.802	0.686
After 60 min	0.567	7.093	1.333	6.348	1.900	1.738	0.279
Heart rate (beats/min) on the 3rd day							
After 5 min	2.900	23.827	1.400	4.039	4.300	4.412	0.334
After 30 min	4.133	21.754	2.467	7.816	1.667	4.220	0.694
After 60 min	4.800	22.258	0.500	7.597	5.300	4.294	0.222
Systolic blood pressure (mmHg) on the 2nd day							
After 5 min	3.067	20.718	0.667	12.960	3.733	4.462	0.203
After 30 min	2.667	20.704	1.200	13.976	3.867	4.561	0.200
After 60 min	1.400	10.578	0.700	15.764	0.700	3.466	0.580
Systolic blood pressure (mmHg) on the 3rd day							
After 5 min	2.800	10.819	4.500	10.741	7.300	2.783	0.005
After 30 min	0.667	13.785	8.133	11.023	8.800	3.222	0.004
After 60 min	0.733	12.575	4.333	13.565	3.600	3.377	0.145
Diastolic blood pressure (mmHg) on the 2nd day							
After 5 min	0.100	7.540	1.233	7.152	1.333	1.897	0.757
After 30 min	1.933	7.696	0.100	7.014	2.033	1.901	0.855
After 60 min	0.300	8.234	1.433	7.333	1.133	2.013	0.712
Diastolic blood pressure (mmHg) on the 3rd day							
After 5 min	2.733	8.525	1.467	7.964	4.200	2.130	0.027
After 30 min	0.267	10.174	4.600	9.978	4.333	2.602	0.050
After 60 min	0.700	12.421	1.167	7.130	0.467	2.615	0.429

SD: Standard deviation, SE: Standard error

Many studies have been conducted with an aim to decrease anxiety in the patients using aromatherapy.[23,28] In accordance with our results, Muzzarelli *et al*.[33] indicated that inhalation aromatherapy using lavender essential oil had no significant effect on anxiety ($P = 0.630$). The result reported by Garham *et al*.[34] indicated that inhalation aromatherapy did not have any effect on reducing anxiety in patients who underwent radiotherapy; even the level

of anxiety in the control group was less than that in the aromatherapy group. The reason for increase in anxiety level could be due to the association between specific odor and anxiety caused by radiotherapy.

On the other hand, the study of Lehrner *et al*. showed that inhalation aromatherapy with lavender essential oil could reduce the anxiety level before the dental procedure ($P = 0.039$), which was not in accordance with the present study. The length of inhalation in the both studies was 20 min. Perhaps this is due to the doses of lavender used in Lehrner *et al.*'s study. In their study, lavender essential oil combined with orange had been used, whereas in this study, pure herbal essential oil was used.[22]

The study of Conrad *et al*. indicated that inhalation aromatherapy with lavender essential oil could reduce anxiety and depression postpartum, which was not in accordance with the results of this study.[35] The reason for the dissimilarity could be the duration of intervention. In Conrad *et al.*'s study, 15-min sessions as 2 times per week for 4 consecutive weeks were used, whereas 20-min sessions for two consecutive days were used in the present study. The mean level of anxiety might become statistically different between the two groups if the duration of intervention is changed.

The results of the study by Lee *et al*. showed that inhalation aromatherapy with lavender essential oil could reduce anxiety in women undergoing cesarean section, which was not in accordance with the results of this study.[17] The reason for the dissimilar results could be the duration of inhalation. In the study of Lee *et al.*, women received aromatherapy with lavender essential oil for 5 min, whereas it was 20 min in the present study.

In this study, we found that lavender essential oil had no significant effect on the vital signs except systolic blood pressure. In accordance with the results of our study, Hwang *et al*.,[36] in their investigation on the effect of inhalation aromatherapy with lavender essential oil on blood pressure, reported that lavender could significantly reduce the blood pressure ($P < 0.05$).

On the other hand, Shiina *et al*.[5] reported that lavender essential oil had no effect on blood pressure. The discrepancy between the study results may be due to the difference in the dose of lavender used in the studies. Rho *et al*.[37] reported that aromatherapy had no significant effect on the respiratory rate as we showed in this study.

Limitations of the study are with regard to the relationship between smells and memories. Smells can trigger memories. If the smell of essential oils closely associated with the negative memories is applied to the patient, it may lead to negative results.

Conclusion

In summary, inhalation aromatherapy with lavender essential oil had no significant effect on anxiety and vital signs, except for systolic blood pressure, in patients who had undergone coronary artery bypass surgery; so our hypothesis was rejected. These results could be influenced by the relationship between specific smell and stressful experience in coronary artery bypass surgery. Applying inhalation aromatherapy with lavender essential oil can be considered by nurses, physicians, and other members of the treatment team based on the results of this study and also since using complementary methods reduces the side effects of medications. Further studies about the long-term effects of usage of this method for reducing anxiety are recommended.

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