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Original Article

The Effects of Deep-Breathing Exercises on Postoperative Sleep Duration and Quality in Patients Undergoing Coronary Artery Bypass Graft (CABG): a Randomized Clinical Trial

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ABSTRACT

Introduction: Disordered sleep occurs frequently in patients who have undergone coronary bypass graft surgery, and it contributes to increased morbidity, mortality, and resource utilization. The present study aimed to determine the effects of deep-breathing exercises on postoperative sleep duration and quality in patients undergoing coronary artery bypass graft.

Methods: This study was a clinical trial. The study sample included 64 patients who were coronary artery bypass graft hospitalized from January 2015 to April 2015 in Qazvin Booali-Sina hospital. The patients were selected by convenient sampling and then the participants were randomly allocated to the intervention and control groups. The baseline and postoperative (day 7) sleep duration and quality metrics were measured. The St Mary's Hospital Sleep Questionnaire was used to evaluate sleep quality in two groups.

Results: Baseline night sleep duration was 5.72 (1.63) hours in the control group and 5.58 (1.07) hours in the intervention group. The initial findings showed that the mean of sleep quality score of patients in the intervention and control groups were 19.72 (2.68) and 18.22 (3.81) respectively. These measurements did not decline postoperatively in the intervention group while night sleep duration and quality declined in the control group. Deep breathing exercise program had a significant effect on sleep quality score in the intervention group compared to the control group.

Conclusion: The results indicated that deep breathing exercises prevent decline in sleep quality postoperatively. It seems to be a safe method with no side effects for these patients. Furthermore, it is a simple method to implement and does not impose a high cost.

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Introduction

Sleep disorders are the most common health problem for coronary artery bypass graft (CABG) patients. This disorder has been explored for more than 30 years[1] and is known to have a great impact on the emergence of disabilities and death, as well as, longer hospitalization period and the ensuing costs.[2] Inadequate sleep weakens the immunity system and leads to the decrease in the performance of hypothalamus, pituitary and adrenal glands days after operation,[3] which enhance the risk of developing impaired Glucose tolerance, higher blood pressure, and the probability of the cardiovascular diseases.[4,5] The decline of physical performance, a decrease in the concentration and learning abilities are among the other side effects of having insufficient sleep.[3] Sleep disorders are the most important issues of health care.

Insufficient and poor sleep quality relates to higher blood pressure, irritability, depression, confusion, and a decrease in overall satisfaction with life[2,6] RAM sleep and deep sleep have been found to decrease immediately after surgery in patients.[7] Research has established an association between sleep quality and quality of life in patients undergoing CABG.[8] Shalmon et al.,[9] reported that 95 percent of patients undergoing cardiac surgery had sleep disorders on the first day after surgery, which was related to several factors. Although drug therapy is the most common way of solving sleep problems and medication is relatively safe and of good efficiency, this conventional treatment could have certain side effects, generally occurring after high dosages and long period of application.[10] Deep breathing exercises are a complem_ entary and non-invasive treatment[11] to positively influence insomnia, cardiac autonomic function,[12] depression, anxiety, high blood pressure,[11] and lung diseases.[13] It has been shown to offset body and brain function, consciousness-unconsciousness, and sympathetic-parasympathetic systems function, it is thus considered as an excellent tool to facilitate relaxation.[14] Daily breathing exercises can reduce insomnia.[15] Chien et al., supported the hypothesis that the cognitive behavioral intervention combined with a breathing relaxation exercise could improve sleep quality and heart rate variability in patients with major depression[16] Although deep breathing exercises have an obvious impact on preventing further postoperative pulmonary problems in cardiac surgery,[17,18] few investigations have focused on the association between deep breathing exercise and sleep quality,[19] with almost no studies investigating the influence of deep breathing exercises on sleep duration and quality among patients undergoing coronary artery bypass graft during hospitalization. Therefore, this study set out to determine

the effects of deep-breathing exercises on postoperative sleep duration and quality in patients undergoing coronary artery bypass graft (CABG).

Materials and methods

The present study is a randomized control trial conducted on patients who had undergone CABG from January 2015 to April 2015 in cardiac surgery ward of Qazvin Booali-Sina hospital. Using Stata software and taking into account the P1 = 0.40 (proportion of patients with good quality of sleep in control group), P2 = 0.70 (expected proportion of patients with good quality of sleep in intervention group), α = 0.05, and power = 0.90, the required sample size was estimated equal to 26 in each groups. Taking into account the drop-out and missing data, the minimum sample size estimated as 32 in each groups. Based on the inclusion criteria patients were selected and were randomly allocated into two groups; the intervention (recipient of Deep breathing exercises training) or the control (without Deep breathing exercises training). The study was approved by the ethics committee of Qazvin University of Medical Sciences (N: 38.20.9821) and registered in Iranian Registry of clinical trials (IRCT) at the number IRCT2014070518353N1.

Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.

Prior to data collection, the participants received an explanation on the project, they were free to participate. All subjects provided written informed consents. The inclusion criteria included patients of both genders between 30 and 69 years of age, ability to read and write, stabilization of vital signs [blood pressure, pulse, respiration).We excluded patients who had a history of severe mental diseases resulting in hospitalization and drug treatment within the previous 6 months; had used any kind of other complementary methods such as massage therapy, aromatherapy, etc. to treat sleep disorders for the previous two weeks; or had a history of sleep or respiration disorders and used CNS medications in the night.

At first the duration and quality of the participants' sleep in the two groups (control and intervention) were measured by the St Mary's Hospital Sleep Questionnaire (SMHSQ) preoperatively, and then the participants in the intervention group were taught how to perform the deep breathing exercise techniques by a trained nurse. Deep breathing exercise was to be done through slow and deep inspiration from the mouth or nose to take as much air as possible into their lungs, hold the breath for 2-5 seconds and then breathe the air out slowly through their mouth until some air was left in their lungs.[18] On the morning of the fourth day after surgery and after the patient's hemodynamic status was stabalized, the intervention group started deep breathing exercise program; the patients were advised to perform breathing exercises from morning to night, every three hours; each session consisting of 10 deep breaths with a few seconds pause between each set,[19,20] for 3 days. In the intervention group performance of breathing program was documented in the related form. In order to assure the process of practices, the patients were reminded of breathing exercise times by the researcher. Finally, we filled out the St Mary's hospital sleep quality questionnaire for the intervention group three days after they had performed deep breathing exercise (7th day post CABG) and for the control groups, it was completed on the seventh day in the postoperative period.

St Mary's hospital sleep questionnaire, (SMHSQ), was used to evaluate the previous night sleep quality in the participants. The questionnaire included 8 questions about sleep duration during day and night , the amount of satisfaction with sleep, depth of sleep ,the sleep quality, waking numbers during sleep and amount of waking consciousness as measured according to the following scale: 1 for never, 2 for very little, 3 for little and 4 for many. The lowest score for good quality sleep (lowest sleep disorder) is 8 which means lack of problem and the highest score was 32 which means the highest amount of poor sleep quality.[21,22] Brian Ellis B W et al., have reported reliability and variability 0.70-0.96 (P<0.0001(of the St Mary's hospital sleep questionnaire,[23] in their study reliability of the questionnaire was calculated to be 0.91 through using Chronbach's alpha.

Data analysis was done by SPSS (version 13.0, Chicago, IL, USA); Students Paired t test examined or evaluated sleep quality scores before and after the intervention. Kolmogorov Smirnov test was used to examine the normality of variables of interest. The data were recorded as mean plus or minus standard deviation (SD) for normally distributed variables. A P≤0.05 was considered significant.

Results

A total of 64 patients (16 women and 48 men) were enrolled in the study (Figure 1).

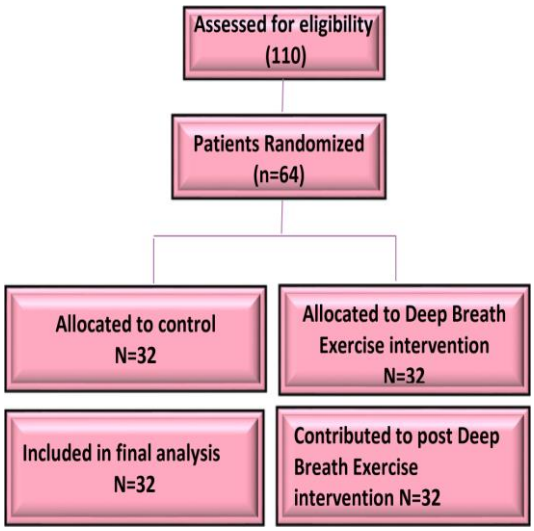

Figure1. Flowchart of study

The mean age of the intervention and control groups were 56.87(6.77) years; and 54.75 (7.28) years respectively. All participants were married and had not reported any history of respiratory diseases and alcohol abuse. Socio-demographic metrics were not significantly different between the two groups. The baseline characteristics of both the intervention and control group are shown in (Table 1).

Baseline night sleep duration was 5.72 (1.63) hours in the control group and 5.58 (1.07) hours in the intervention group. The difference was not statistically significant between the two groups (P = 0.658). Statistical paired t-test showed that there is a significant difference between the mean of night sleep duration baseline and after deep-breathing exercises in the postoperative period (P=0.004) in the intervention group. Baseline score of sleep quality was 18.22 (3.81) in the control group and 19.47(2.68) in the intervention group. The score of sleep quality post operation (after deep-breathing exercises) was 19.50 (3.60) in the intervention group while it was reduced to 14.97 in the control group (4.73). Paired t-test showed a significant difference in the two groups (P=0.002). The results showed that baseline sleep duration and quality were similar between the two groups and there had not been any difference between the intervention and control groups for sleep duration and quality before operation (Table 2).

Table1. Socio-demographic characteristics of patients in the intervention and control groups (n=32)

Variable	Group		P
	Control	Intervention	
Gender			0.248
Male	22(68.8)	26(81.2)	
Female	10(31.2)	6(18.8)	
Residence			0.396
Urban	25(78.1)	22(68.8)	
Rural	7(21.9)	10(31.2)	
Educational level			0.362
Ability to read	24(5.0)	21(65.6)	
Secondary school	3(9.4)	3(9.4)	
High school	4(12.5)	3(9.4)	
University education	1(3.1)	5(15.6)	
Use of pharmacological sleep aides history			1.000
Yes	2(6.2)	2(6.2)	
No	30(93.8)	30(93.8)	
Smoking history			1.000
Yes	11(34.4)	11(34.4)	
No	21(65.6)	21(65.6)	

Table 2. Mean and standard deviation of sleep duration and sleep quality scores of the subjects before and after deep berating exercise program in intervention and control group

Variable	Group		Paired t-test	P
	Control	Intervention		
Night sleep duration before operation	5.72(1.63)	5.58(1.07)	0.408	0.685
Night sleep duration after operation	4.43(1.41)	5.41(1.17)	3.0	0.004
Scores of sleep quality before operation	18.22(3.81)	19.47(2.68)	1.519	0.134
Scores of sleep quality after operation	14.97(4.73)	19.50(3.60)	4.309	<0.001

The results revealed that sleep duration and quality of the group who had received deep breathing exercise training was different from those of the control group, and that the difference was significant (P<0.001).

The mean (standard deviation) of sleep scores are presented in the table 2 for both control and intervention groups. The results showed that deep breathing exercises significantly increased the deepened sleep, increased cheerfulness during the day, and increased individual sleep-satisfaction in the intervention group.

Discussion

Nowadays, coronary artery bypass graft surgery is a regular treatment for coronary artery disease. However, patients undergoing CABG surgery often complain about sleep disturbances and short sleep duration; poor sleep is a major physical distress after surgery.[24] our study focused on the effect of deep breathing exercise on the sleep duration and quality in patients undergoing CABG.

The results of the present study showed that short sleep duration and poor sleep quality is a common problem among patients undergoing CABG. Several studies have reported postoperative sleep duration to be at its worst during hospitalization, with sleep duration gradually increasing after 6 months.[1,25] Some studies have emphasized that poor sleep quality is associated with a higher occurrence of harmful preoperative events in patients undergoing CABG surgery.[26] A comprehensive evaluation of sleep problem is necessary for poor sleep management.[24] However, the effect of deep breathing Exercise on the sleep duration and quality in patients

undergoing CABG is unclear. In the present study, we have shown that the drop in the mean of night sleep duration was less in the deep breathing exercise group, as compared to the control
Group in post-operative phase. Khalsa et al.,[27] have reported similar outcomes for yoga exercises that showed an ability to increase the patients' sleep duration. Casida et al.,[28] in a pilot randomized controlled trial, have also confirmed the effects of guided imagery program on improving sleep in patients undergoing cardiac surgery. There have been some studies describing the positive effects of post-operative breathing exercises for cardiac surgery patients,[29-31] particularly deep breathing exercises after the CABG, which are provided to prevent loss of significant sleep duration.

The main reason for the increase in sleep duration of patients in the intervention group was the fact that breathing is an excellent tool to facilitate relaxation, [14]and it seems to be a safe method with no side effects[11] to eliminate insomnia[12] Furthermore, breathing exercises can Be used to establish a balance between body and brain, alertness and non-alertness, and sympathetic and parasympathetic neural systems.[14] So, patients exhibiting insomnia often respond positively to daily breathing exercises.[15] Our results also showed that all patients experienced poor sleep during hospitalization and recovery stages, whereas the mean scores of sleep quality had not decreased in deep breathing exercise group after CABG, as compared to the control group. These findings are in agreement with those of Alkan et al.,[19] who reported that implementing intervention, using the breathing exercises program could improve sleep quality for patients with chronic heart failure group .Roy[13] in a study on patients with upper abdominal surgeries found that deep breathing exercises can lead to changes in the sleep process and quality by counteracting the short breaths. Scientific evidence indicated that deep breathing can facilitate the oxygen transfer to cells and reduce lung problems that may occur after operations.[31] Earlier studies have emphasized breathing practice to be an effective intervention for the reduction of anxiety and stress[15] Ma et al.,[32] in a randomized controlled survey reported that diaphragmatic breathing training could improve cognitive performance and reduce stress in Chinese healthy adults.

In addition, deep breathing helps people reach relaxation prior to falling asleep at night and facilitates a decline in insomnia[17] postoperatively, patient's exhibit lung problems and disorders in gas exchange, and therefore, breathing exercises are often prescribed to decrease or prevent such side effects. Various breathing exercises are one of the main components in postoperative care.[23]Pettersson et al., reported that the performance of deep breathing exercises in a standing position improved oxygen saturation (SpO2) more than a sitting position on Swedish patients after CABG.[33] The importance of improving the patients' sleep duration and sleep quality through non-pharmacological interventions is a clear-cut issue. The results of the current study showed that deep breathing exercises significantly increased the depth of sleep, increased cheerfulness during the day, and increased individual sleep-satisfaction in the intervention group. The effect of complementary medication to improve the sleep quality in postoperative patients has been well documented; in a systematic review Machado and colleagues[34] demonstrated that non-pharmacological interventions had beneficial effects on the patients' sleep after their cardiac surgery. Ryu et al.,[35] concluded that music therapy could significantly increase angioplasty patients' sleep quality; Furthermore, Ranjbaran et al.,[36] emphasized that an additional intervention to CABG bypass patients' recovery plans, based on a proper pattern, may improve their postoperative sleep quality. They also reported that the heart recovery program, which included breathing exercises and training sessions, could improve the quality of life and lower stress after CABG.

Importantly, the consideration of patients' postoperative sleep patterns is critical as there is a positive correlation between sleep pattern and life quality.[37] Our results have confirmed the hypothesis that deep breathing exercises can exert positive effects on CABG patients' sleep duration and quality. Although these exercises have not been able to influence all aspects of hospital sleep quality, it may be applied as a modern medical intervention due to its promising impact on the quality and depth of sleep experienced by the patient. The investigation of the impact of deep breathing exercises on the sleep quality in CABG patients in the present study showed that, in more than half of the cases, practicing deep breathing exercises was effective in preventing loss of significant hospital sleep quality.

The strength of the present study stemmed from the experimental design in which the patients were randomly allocated into two separate groups, both containing patients with similar demographic information. The present study was limited by the relatively small sample size and that the sleep duration and quality data were subjective and qualitative.

Conclusion

The results of the present study show that deep-berating exercises prevent decrease in sleep quality postoperatively. It seems to be a safe and simple method with low cost and no side effects. Future studies should be conducted with the intent to investigate the effects of breathing exercises on sleep quality in special patients and in various age groups. It is also recommended that the effects of deep breathing exercises be measured objectively under polysomnography, a golden standard of sleep quality investigation.

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Ethical issues

None to be declared.

Conflict of interest

The authors declare no conflict of interest in this study.

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