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Evaluating the impact of Benson's relaxation technique on anxiety and delirium among coronary artery bypass graft surgery patients

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Abstract

Background Anxiety and delirium are prevalent complications in cardiac patients undergoing invasive procedures like coronary artery bypass surgery, with untreated symptoms potentially leading to enduring physical and psychological consequences. Benson's relaxation technique, a method of attention focusing, has demonstrated efficacy in alleviating various symptoms, although findings are conflicting. Thus, this study aimed to assess the influence of Benson's relaxation on anxiety and delirium severity in open-heart surgery candidates.

Methods Conducted in 2022 at Qaem Hospital in Mashhad, this randomized controlled trial involved 60 patients. The intervention group received Benson's relaxation training pre-surgery and practiced it twice daily for 72 h post-admission. Standard care was provided to controls. Anxiety and delirium were assessed using standardized scales before and after the intervention.

Results The demographic characteristics of both groups were comparable with no significant differences. Benson's relaxation significantly reduced delirium scores on the first and second days post-surgery ($P<0.001$). However, the difference in delirium scores between the groups was not significant on the third day ($P=0.129$). While the intervention led to a significant reduction in anxiety within the intervention group, no significant difference in anxiety reduction was observed between the intervention and control groups ($P=0.579$).

Conclusion Incorporating Benson's relaxation technique, which showed significant effects in reducing early postoperative delirium, into postoperative care plans for open-heart surgery patients warrants consideration. However, given the lack of a significant effect on anxiety reduction compared to routine care, further research is necessary to evaluate its long-term effectiveness and broader impact on psychological outcomes.

Trial Registration This study was registered in the Iranian Registry of Clinical Trials (no. c IRCT20210903052365N1) on 2022-01-28.

Keywords Coronary artery bypass graft surgery, Benson's relaxation, Delirium, Anxiety

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Introduction

Cardiovascular diseases are the leading cause of mortality in Iran, accounting for 33 to 39.3% of deaths and making the country the highest in global cardiac mortality rates, which continue to rise [1, 2]. Coronary artery disease (CAD) is the most prevalent form of cardiovascular disease in adults [3, 4]. Among various treatment methods, coronary artery bypass graft (CABG) surgery stands out as a significant and effective invasive procedure, with a history of over 40 years [5]. In Iran, more than 50,000 cardiac surgeries are performed annually, with 50 to 60% being CABG procedures, a prevalence that has increased due to lifestyle changes [1]. It is estimated that one in three American adults suffers from one or more cardiovascular diseases. Worldwide, 1.25 to 1 million adult heart surgeries are performed each year, with CABG being the most common type of heart surgery [6].

Anxiety is a common response to the stress of undergoing CABG procedures, and it can manifest both before and after the procedure [7, 8]. Anxiety and related disorders (agitation, restlessness, etc.) are observed in approximately 85% of ICU patients [9]. Research has indicated that elevated anxiety levels can lead to increased perioperative complications, delayed recovery, and poorer psychological well-being.Consequently, anxiety leads to an increase in cortisol and adrenaline levels, which is a physiological response. Anxiety negatively affects tissue healing and recovery; moreover, by stimulating the sympathetic system, it leads to an increase in heart rate, blood pressure, and a decrease in blood supply to the wound. If anxiety is not controlled or persists, it may lead to increased protein breakdown, impaired wound healing, and an increased risk of infection. These factors contribute to prolonged hospital stay and delayed patient discharge [10].

Similarly, postoperative delirium, characterized by acute confusion and altered consciousness, is a critical concern in CABG patients, particularly among the older people. Delirium not only affects the patient's immediate recovery but can also lead to long-term cognitive decline. Postoperative delirium can manifest as confusion, agitation, and altered consciousness, often triggered by factors such as anesthesia, pain, medications, and pre-existing cognitive impairment. Delirium is also a neurological disorder reported in 16 to 89% of ICU patients. The diagnosis of delirium is challenging for the treatment team. This complication is particularly common in ventilator-dependent patients, older patients after surgery, and in patients undergoing heart surgery [9, 11].

Anxiety can lead to increased physiological stress responses, which may heighten the risk of developing delirium. Conversely, delirium can significantly impact a patient's ability to engage in recovery, leading to longer hospital stays and poorer overall outcomes. The interplay between anxiety and delirium can negatively influence the patient's quality of life, affecting their emotional well-being and satisfaction with care. Both anxiety and delirium may share common pathophysiological pathways, including neuroinflammatory responses and disruptions in neurotransmitter systems. This overlapping can exacerbate symptoms of both conditions.

Due to the high cost and adverse effects of pharmacological methods for controlling and treating anxiety and delirium, as well as the dependency on these drugs, non-pharmacological methods can be utilized for patients. Since nurses in clinical settings spend more time with postoperative patients compared to other members of the treatment team, they are in the best position to reduce anxiety and delirium and can easily employ non-pharmacological treatments for this purpose [12, 13]. Various nursing interventions as complementary and non-pharmacological treatments include relaxation techniques [14–16, 17]. Relaxation is a method through which an individual can consciously induce changes in physical, emotional, and behavioral states resulting from tension. Benson's relaxation is based on coping with sympathetic activity by increasing parasympathetic activity. Relaxation can reduce emotional and muscular tension associated with pain, and it has various methods, but the technique introduced by Herbert Benson (1970) is more preferred than other methods due to its easy learning and teaching [18, 19].

Although the benefits of relaxation techniques are well-documented in various contexts, limited research specifically addresses its effects on postoperative outcomes in cardiac surgery patients, particularly in managing postoperative delirium and anxiety. Therefore, this study was conducted to fill this knowledge gap and evaluate the effectiveness of Benson's relaxation technique in improving psychological outcomes following open-heart surgery.

Methods

Trial design

This study employed a randomized two-group clinical trial design involving 60 hospitalized patients in the Intensive Care Unit (ICU) of Qaem Hospital, Mashhad University of Medical Sciences, during the period from February 2022, to August 8, 2022 (Fig. 1).

Participants

Inclusion criteria comprised an age range of 18–64 years, confirmed absence of auditory problems through a verbal screening process (patients were asked if they experienced any hearing difficulties in daily conversations, as well as if they could comfortably listen to and comprehend audio instructions using standard mobile devices), Non-use of tranquilizers and anti-anxiety medications

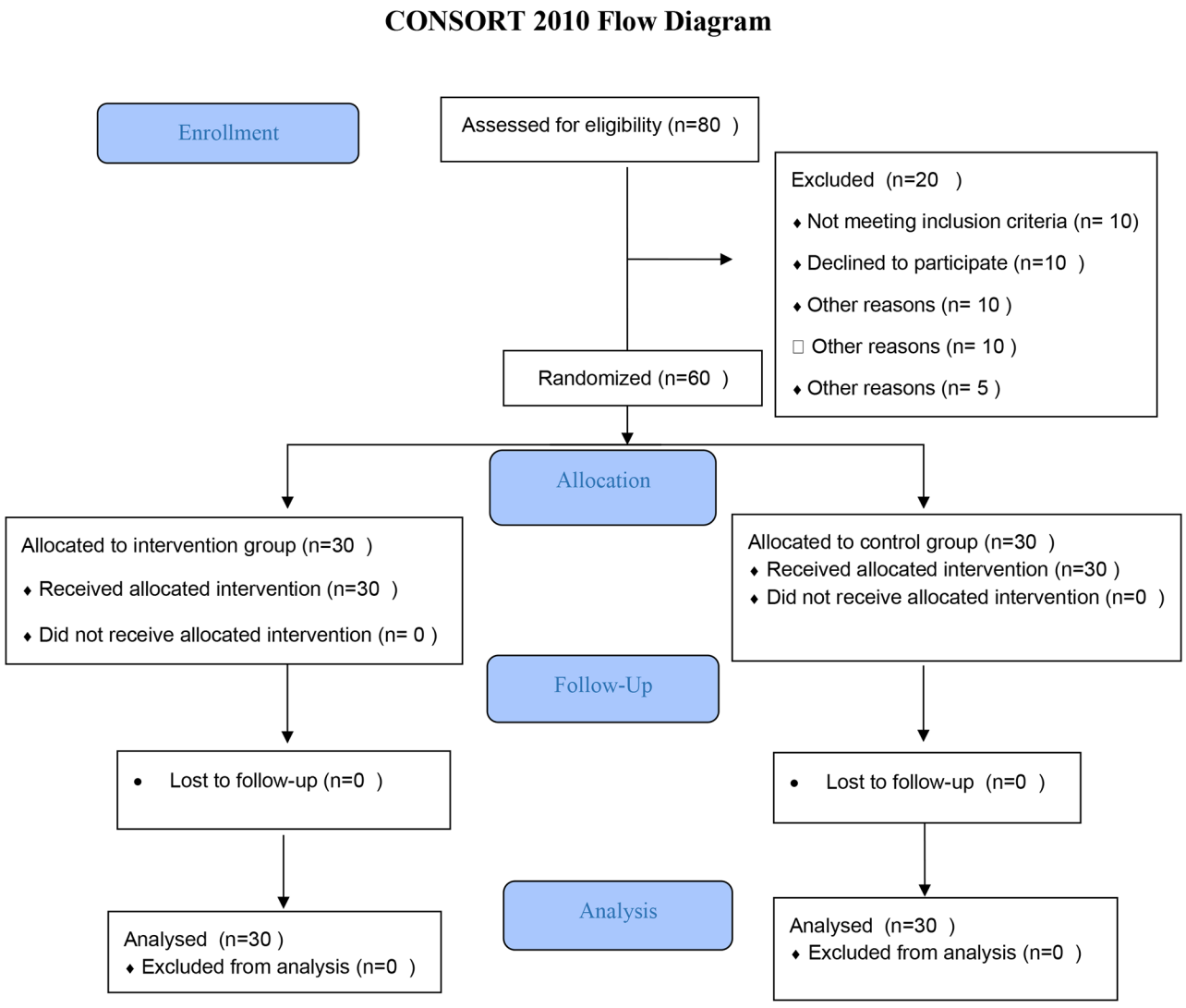

Fig. 1 The CONSORT checklist of study

during the research, Non-substance abuse, Absence of confirmed psychiatric disorders by a psychiatrist, First experience of open-heart surgery, No participation in similar muscle relaxation courses, Absence of relevant education in medical sciences or psychology, Absence of muscular paralysis or disorders in the musculoskeletal system, Minimum education of middle school level, Patient or their companion equipped with a smartphone, Patient being separate from mechanical ventilation and fully conscious, Informed consent to participate in the study. The exclusion criteria are: lack of willingness and consent to continue participating in the study, absence from one of the relaxation sessions, participation in another educational relaxation program, and death of the patient.

Clarification: Auditory function was assessed through a verbal screening in which participants were asked to confirm whether they could hear and understand audio files played on standard mobile devices and whether they experienced any difficulties in normal conversations. This screening ensured that patients could adequately engage with the relaxation intervention without requiring additional auditory tests, as the use of audio files was central to the intervention.

Intervention

After obtaining ethical approval from the regional ethics committee of Mashhad University of Medical Sciences and the School of Nursing and Midwifery, a letter of introduction was received from the School of Nursing and Midwifery and presented to the authorities of Qaem

Hospital in Mashhad. With coordination with the officials of selected departments, convenience sampling was used to recruit participants in the cardiac surgery department. The sampling process was conducted in three shifts—morning, afternoon, and night—over a defined period, ensuring the inclusion of patients who met the eligibility criteria during their hospital admission. This method was chosen to allow for the continuous and practical selection of available patients undergoing open-heart surgery while maintaining the required study conditions and ethical considerations.

Most patients had a chest tube in place for drainage, which is common after heart surgery. To ensure the feasibility of the intervention despite the presence of the chest tube, patients were instructed to perform the relaxation technique while lying in a comfortable, immobile position to avoid exacerbating any discomfort caused by movement. Additionally, the intervention was performed at times when patients had received their prescribed pain medication, which helped control severe pain related to the chest tube. The presence of chest tubes did not affect the intervention's execution, as pain was managed through medication and careful patient positioning. The researchers closely monitored the patients' pain levels and only proceeded with the relaxation session when the patient expressed readiness and comfort. This approach ensured that the intervention could be carried out without causing unnecessary strain or pain for the patients.

Before the intervention, the study groups were divided into two intervention and control groups. On the first day of sampling, the researcher established communication with the patients and provided verbal explanations about the research objectives and methods for approximately 15 min. Informed consent was obtained from patients meeting the study inclusion criteria by completing a written informed consent form, and eligible individuals were selected based on the research unit selection checklist. Additionally, personal information forms were completed by research units. Their anxiety was also assessed using the Spielberger State-Trait Anxiety Inventory, and patients' delirium was assessed using the Neelon and Champagne Confusion Scale.

The time interval between completing the questionnaires and conducting the intervention was approximately 1 to 2 h. During this time, patients rested, and the researcher ensured they were stable and prepared for the intervention. The Benson relaxation technique was conducted following this interval, ensuring that the intervention did not immediately follow the completion of the questionnaires. This break allowed patients to mentally and physically prepare for the intervention, ensuring its effectiveness and comfort.

Patients were assessed at two stages: 24 h after admission to the ICU and again 72 h post-admission. It should be noted that the intervention was conducted both in the intensive care unit (ICU) and, for some patients, in the surgical ward after their transfer from the ICU. The cardiac ICU in Qaem Hospital consists of 10 beds, and patients are admitted to this unit immediately after open-heart surgery. Once patients have shown signs of recovery, typically 72 h post-surgery, they are transferred to the cardiac surgery ward, which has 17 beds. The intervention was initiated in the ICU, where most patients remained for 48 to 72 h post-surgery, depending on their recovery and clinical stability. However, patients were included in the study regardless of whether they were transferred from the ICU to the ward within this time frame. In cases where patients were transferred earlier, the intervention continued in the ward to ensure consistency across different care environments. During these times, researchers ensured that the patients were lucid and stable, with minimal to no sedation, and physically capable of answering the questionnaire. In cases where patients had difficulty, the researcher read the questions aloud and recorded the answers, ensuring accurate responses at both stages. This procedure was in line with ethical guidelines and aimed at minimizing the burden on critically ill patients.

In the intervention group, patients were taught Benson's relaxation technique for 20 min the day before surgery in one of the department rooms with prior coordination. Patients were then asked to practice this technique again in the same location and in the presence of the researcher to ensure the accuracy of learning. To facilitate the technique execution, prevent forgetfulness, overcome environmental noise, and standardize the intervention, an audio file containing standardized instructions for relaxation was installed on the patient's smartphone (compatible with Android versions), and noise-canceling headphones were provided to patients for use in the ICU or ward at consistent intervals over three days. Benson's muscle relaxation was performed by instructing patients to lie down in the most comfortable position where they felt relaxed, close their eyes, select a calming word (such as God, love, rain, rainbow, etc.), and begin deep and regular breathing through their nose, exhaling through their mouth while repeating the chosen word in their mind. Simultaneously, they relaxed their leg muscles starting from their toes, progressively moving upward until all body muscles reached full relaxation, maintaining this state for twenty minutes before opening their eyes.

These sessions were conducted three times a day—morning (9 AM), afternoon (3 PM), and evening (9 PM)—to account for potential variations in stress levels throughout the day. Each session lasted for 15 min, a duration selected based on prior studies indicating effective stress reduction. This ensured that stress

levels between the ICU and the ward were standardized, despite differences in environment.

The intervention was conducted primarily in the ICU during the first two days post-surgery and continued in the ward if the patient was transferred. Specifically, Benson's relaxation technique was performed during the first two days in the ICU, with sessions scheduled to minimize patient discomfort. If patients were transferred to the ward after 48 h, the final day of the intervention was conducted in the ward. This ensured consistency in the intervention across different environments (ICU and ward). In the control group, only routine departmental measures (verbal explanations by nurses, provision of educational pamphlets, routine nursing care) were performed over the same three days (24, 48, and 72 h after patient admission to the ICU). Immediately after the intervention's completion in the intervention group and provision of routine departmental care for the control group patients, anxiety was reassessed using the Spielberger State-Trait Anxiety Inventory, and delirium was assessed using the NEECHAM Confusion Scale. Both groups of patients were assessed.

In order to minimize the risk of infection during the study, several precautions were implemented. Standard infection prevention protocols were strictly followed throughout the trial, including the use of sterile techniques during all interactions with patients. All medical staff involved in patient care adhered to hospital guidelines for hand hygiene, wearing gloves, masks, and gowns, and disinfecting equipment and surfaces before and after each use. The relaxation sessions, which involved patient interaction, were conducted in a clean and controlled environment, with the patients' personal mobile devices being disinfected prior to use in the ICU and ward. Additionally, to further reduce the risk of infection, all patients in both the intervention and control groups received standard postoperative antibiotic prophylaxis as part of routine care, as recommended by the cardiac surgery department.

Outcomes

The research tools used in this study consisted of a demographic information questionnaire, the NEECHAM confusion scale to measure delirium levels, and the Spielberger State-Trait Anxiety Inventory (STAI) to measure anxiety.

Demographic Information Questionnaire: This section included questions on age, sex, education, marital status, hospitalization history, income status, and duration of connection to the mechanical ventilation device in the cardiac ICU (hours). Information regarding mechanical ventilation was collected from the patient's medical records, while other demographic information was obtained from patients through interviews conducted prior to the intervention.

Spielberger State-Trait Anxiety Inventory (STAI): The STAI, designed by Charles D. Spielberger in 1983, is a self-assessment tool for measuring both state and trait anxiety, structured as a Likert scale. The questionnaire comprises 20 questions and has been translated into multiple languages, including an adaptation for Iranian culture. The Persian version of the STAI, which has been psychometrically validated, was used in this study. The Persian translation's validity and reliability have been confirmed by faculty members at Shahid Beheshti University and the Tehran Psychiatric Institute. The reliability of this questionnaire has been reported as 0.87 in various studies, and in Iran, its reliability was confirmed through Cronbach's alpha, resulting in a coefficient of 0.91 for state anxiety. Its validity has been established using the concurrent criterion method. Therefore, the validity and reliability of the Persian version were not reassessed in this study as it has already been psychometrically evaluated in previous research.

Measurement Timing: In this study, anxiety was measured at two time points: once before surgery (pre-intervention) and once on the first postoperative day (post-intervention). Delirium levels were assessed four times: before the intervention, and on the first, second, and third days after surgery.

NEECHAM Confusion Scale: Developed by Neelon and Champagne in 1996, the NEECHAM confusion scale assesses acute confusion and delirium. The scale includes three levels:

Information Processing: Attention and alertness (0–4 points), verbal and motor response (0–5 points), memory and orientation (0–5 points).

Behavioral Level: General behavior and status (0–2 points), sensory-motor performance (0–4 points), verbal responses (0–4 points).

Physiological Performance: Vital signs (0–2 points), oxygen saturation level (0–2 points), urinary control (0–2 points).

The maximum score on this scale is 30, with scores ranging from zero to 19 indicating moderate to severe delirium, scores from 20 to 24 indicating mild or initial delirium, and scores from 25 to 30 indicating normal functioning and absence of delirium. The scale's validity and reliability have been confirmed in a study by Gemert van et al. in 2007, reporting a reliability of 0.93. The Persian version's validity and reliability have also been confirmed in Iran by Eshtarian et al., identifying it as a strong predictor for delirium. In this study, the NEECHAM confusion scale was completed based on the opinions of the caring nurses who had taken care of the patients for at least 24 h, ensuring accurate assessment of the patients' condition.

Sample size and randomization

To determine the sample size, a pilot study was conducted on 10 individuals in each group using delirium scores as the main variables. The sample size was calculated based on a 95% confidence level and 80% test power [20]. The formula used for determining the sample size is as follows:

n = (Z_(1-α2)+Z_(1-β))^2 × [S_1^2+S_2^2] / (X_1 - X_2)^2.

- S_1 = 6.13 (standard deviation of anxiety score in the intervention group).
- S_2 = 10.53 (standard deviation of anxiety score in the control group).
- X_1 = 39.14 (mean anxiety score in the intervention group).
- X_2 = 56.73 (mean anxiety score in the control group).
- Z_(1-α2) = 1.96 (z-value for a 95% confidence level).
- Z_(1-β) = 0.84 (z-value for 80% test power).

The minimum required sample size for each group was calculated as 30 participants, which is consistent with findings from previous studies in similar settings [21, 22].

Randomization was carried out using block randomization, designed to ensure an equal number of participants in both intervention and control groups. The block size used was four (blocks of two patients per group), ensuring that after every four patients, two were allocated to each group, maintaining balance throughout the study. Random sequence generation was done using a computer-based random number generator (randomizer.org). The first patient was allocated to the intervention group, and subsequent participants were assigned according to the generated random sequence. The allocation concealment was ensured through the use of sealed, opaque, and sequentially numbered envelopes containing the group assignment for each participant. The envelopes were prepared by an independent researcher who had no involvement in the recruitment or data collection. Participants were recruited by clinical staff, who were unaware of the allocation sequence, ensuring unbiased enrollment. The control group received standard care while the intervention group underwent Benson's relaxation technique. While blinding participants in this study was challenging due to the nature of the intervention, outcome assessors and statisticians remained blinded to the group allocations to minimize bias.

Statistical methods

Descriptive statistics such as mean, standard deviation, median, and interquartile range were used for quantitative variables, while frequency distribution tables or graphs were used for qualitative variables. For comparing quantitative variables between the intervention and control groups, the Mann-Whitney U test was employed for non-normally distributed variables. Friedman's test was used for within-group analysis of variables. Data analysis was conducted using SPSS version 22, with a significance level of 0.05 in all statistical tests.

Results

Table 1 provides an overview of the demographic characteristics of the Intervention and Control groups. The mean age was 49.5 ± 8.5 years in the Intervention group and 49.7 ± 8.6 years in the Control group. In terms of gender distribution, 53.3% of participants in the Intervention group were male, compared to an equal distribution of

Table 1 Demographic variables of the intervention and control groups

Variable	Group		*P* value
	Intervention	Control	
Age (mean ± SD)	49.5 ± 8.5	49.7 ± 8.6	*$P = 0.941$
Sex n (%)			
Male	16 (53.3	15 (50.0)	**$P = 0.796$
Female	14 (46.7)	15 (50.0)	
Marital Status n (%)			
Single	2 (6.7)	3 (10.0)	***$P = 0.735$
Married	21 (70.0)	17 (56.7)	
Deceased Wife	5 (16.7)	6 (20.0)	
Income Level n (%)			
Less than enough	6 (20.0)	9 (30.1)	***$P = 0.427$
Enough	21 (70.0)	19 (63.3)	
More than enough	2 (6.6)	3 (10.0)	
Duration of connection to the mechanical ventilation device (hours)	9.6 ± 4.8	8.9 ± 2.3	****$P = 0.905$
Duration of hospitalization in ICU (days)	2.5 ± 0.8	2.7 ± 1.0	****$P = 0.495$
Duration of heart disease (years)	5.8 ± 2.7	5.5 ± 1.9	****$P = 0.712$

* t test ** Chi-square ***Fisher exact test **** Mann-Whitney

Table 2 Mean and standard deviation of manifest anxiety before and after the intervention in the study units in the intervention and control groups

Anxiety	Group		*P*
	intervention (*n* = 30)	control (*n* = 30)	
	Mean ± SD	Mean ± SD	
Before the intervention	50.5 ± 11.5	52.9 ± 10.6	*$P=0.411$
After the intervention	38.9 ± 8.8	37.9 ± 8.2	*$P=0.579$
Intragroup Comparison	***$P<0.001$	**$P<0.001$	

* Mann-Whitney ** Wilcoxon test *** Paired t test

Table 3 Mean and standard deviation of delirium scores before the intervention and on the first, second, and third days after surgery in the study units in the intervention and control groups

Delirium	Group		*P*
	intervention (*n* = 30)	control (*n* = 30)	
	Mean ± SD	Mean ± SD	
Before the intervention	29.0 ± 1.4	29.3 ± 1.3	*$P=0.340$
First day	26.3 ± 1.4	24.6 ± 1.5	*$P<0.001$
Second day	27.9 ± 1.0	25.5 ± 1.5	*$P<0.001$
Third day	29.0 ± 1.5	28.1 ± 2.1	*$P=0.129$
Intragroup Comparison	**$P<0.001$	**$P<0.001$	

* Mann-Whitney ** Friedman test

male and female participants in the Control group. Most participants in both groups were married, with 70% in the Intervention group and 56.7% in the Control group. Additionally, 70% of the Intervention group and 63.3% of the Control group reported having sufficient income. Other variables, such as the mean duration of mechanical ventilation, length of ICU stay, and the duration of heart disease, were also similar between the two groups (Table 1).

Table 2 presents the mean and standard deviation of manifest anxiety before and after the intervention in both the intervention and control groups. Prior to the intervention, the mean anxiety score in the intervention group was 50.5 ± 11.5, while in the control group it was 52.9 ± 10.6, showing no significant difference between the groups ($P=0.411$). Following the intervention, the mean anxiety score decreased to 38.9 ± 8.8 in the intervention group and 37.9 ± 8.2 in the control group, with no significant difference between the groups ($P=0.579$). Intragroup comparisons revealed a statistically significant reduction in anxiety scores for both the intervention group ($P<0.001$, paired t-test) and the control group ($P<0.001$, Wilcoxon test). These results suggest that both groups experienced a significant decrease in anxiety levels from pre- to post-intervention, although there was no significant difference between the groups in terms of anxiety reduction (Table 2).

Table 3 presents the mean and standard deviation of delirium scores before the intervention and on the first, second, and third days after surgery for both the intervention and control groups. Prior to the intervention, there was no significant difference in delirium scores between the groups (intervention: 29.0 ± 1.4, control: 29.3 ± 1.3, $P=0.340$). On the first day post-surgery, the intervention group showed significantly higher scores compared to the control group (26.3 ± 1.4 vs. 24.6 ± 1.5, $P<0.001$). This significant difference persisted on the second day (intervention: 27.9 ± 1.0, control: 25.5 ± 1.5, $P<0.001$). However, by the third day, the difference between the groups was no longer statistically significant (intervention: 29.0 ± 1.5, control: 28.1 ± 2.1, $P=0.129$). Intragroup comparisons using the Friedman test revealed significant changes in delirium scores over time for both groups ($P<0.001$). These results suggest that while both groups experienced significant changes in delirium scores post-surgery, the intervention group maintained higher scores on the first and second days compared to the control group (Table 3).

Discussion

The present study was a randomized clinical trial designed to evaluate the effects of the Benson relaxation technique on anxiety and delirium severity in patients undergoing open-heart surgery. Regarding manifest anxiety, our findings indicate that Benson relaxation did not significantly impact anxiety levels. This contrasts with the results from Poralajel et al. (2017) [23], which demonstrated a significant reduction in preoperative anxiety through the same relaxation technique, as assessed using a hospital anxiety tool before and immediately after the intervention. A potential explanation for the differing results may lie in the timing of anxiety assessments. In our study, measurements were taken preoperatively and

postoperatively, while Poralajel's assessments occurred only before surgery. Our results indicate a significant decrease in anxiety for both groups following surgery. The inherent anxiety associated with open-heart surgery, which is often considered a major psychological crisis, likely influences this outcome [24]. As patients cope with the fear of surgery, their anxiety naturally declines over time, which may explain the lack of significant reduction in anxiety levels due to the Benson relaxation technique [25, 26].

Several factors affect cognitive disorders, such as delirium, after surgery, including the side effects of the bypass pump, other known variables, and various unknown factors. These variables, which were not fully discussed in our study, may have influenced delirium outcomes. Other studies, including those by Malmir et al. (2015) [27] and Barabadi et al. (2020) [28], also reported positive effects of Benson relaxation on reducing anxiety when interventions were administered preoperatively. This consistency suggests that the technique is valuable for managing anxiety in various patient populations.

In terms of delirium, our study found that Benson relaxation significantly reduced delirium scores in patients post-surgery, with the intervention group showing lower delirium scores on each of the three postoperative days. Notably, literature specifically addressing the impact of relaxation techniques on postoperative delirium is scarce. However, studies exploring non-pharmacological interventions for delirium have shown promising results. For instance, Biranvand et al. (2007) [29] demonstrated a positive effect of music on reducing delirium in older patients after hip joint surgery, indicating that enhanced alertness and concentration can mitigate delirium.

Other relevant studies have focused on non-pharmacological strategies to reduce delirium in high-risk patients, such as those in intensive care settings. For example, Sherafi et al. (2020) [30] confirmed that creating a calm environment, including the use of earplugs and eye masks, can significantly decrease delirium occurrence. Similarly, Hassan Shahian (2022) found that planned visitation in the ICU reduced delirium, attributing this effect to sensory and cognitive stimulation [31].

The positive effects of increased attention and concentration as outcomes of relaxation techniques have been mentioned in various articles [29]. The results of studies by Lynch et al. (1998) [32], Kousar et al. (2014) [33], and Jacquelin et al. (2013) [34] demonstrate a direct correlation between the presence of pain and the occurrence of delirium in postoperative patients.

Despite the promising findings of this study, several limitations should be acknowledged. First, individual variations in psychological, social, and familial backgrounds among patients may have influenced the outcomes, as these factors are known to affect anxiety and delirium levels. Additionally, the side effects of the bypass pump, which may contribute to cognitive disorders such as delirium, were not discussed in detail, and these could be significant confounding factors. Furthermore, the study's sample size, though adequate for preliminary findings, may not be large enough to generalize the results across broader populations. Another limitation is the timing of anxiety measurements, which may not have fully captured the fluctuations in anxiety levels throughout the perioperative period. Lastly, although measures were taken to control external variables, factors such as differences in postoperative care environments could also have impacted delirium scores.

Conclusion

The use of the Benson relaxation technique has been able to reduce the occurrence of delirium in patients after open-heart surgery, and the application of this method had no effect on the level of manifest anxiety in patients after surgery. Given this positive effect and considering that the Benson relaxation method is a simple and cost-free technique that nurses can easily learn and implement for patients, therefore, training and encouraging nurses in this area should be of concern to nursing managers and health policymakers. Planning by hospital authorities to implement such programs for use by nursing staff and providing the necessary facilities for the implementation of such techniques seems essential.

Abbreviations

ICU intensive care unit
CABG (Coronary Artery Bypass Graft)

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Author contributions

All authors have read and approved the manuscript. Study design: AG, FH; data collection and analysis: AG, KM, SV, HRB; manuscript preparation: MK, FH.

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Data availability

The datasets generated in the present study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the ethics committee of Mashhad University of Medical Sciences (IR.MUMS.NURSE.REC.1399.074) and complied with the Declaration of Helsinki. Informed consent was obtained from all individual participants included in the study. The purpose and importance of the study were explained to participants who met the inclusion criteria, and they signed

a written informed consent form. Patients were informed that they were free to withdraw from the study at any time without any effect on their treatment plan, should they wish to do so. All methods were performed in accordance with the relevant guidelines and regulations, which are aligned with the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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