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Effect of Stretching Combined with a Slow Deep Breathing Exercise on Patients' Anxiety after Coronary Artery Bypass Grafting: A Randomized Clinical Trial

Azam Zarneshan *[1], Naser Safaie [2], Leyla Esmealy [2], Babak Esmealy [3]

1. Department of Sport Science, Azarbaijan Shahid Madani University, Tabriz, Iran
2. Department of cardiology, Tabriz University of Medical Sciences, Tabriz, Iran
3. Department of Sport physiology, Tabriz University, Tabriz, Iran

Correspondence Azam Zarneshan, Department of Sport Science, Azarbaijan Shahid Madani University, Tabriz, Iran. Tel: +989383560486, Email: zarneshan@azaruniv.ac.ir

Abstract

Background: Anxiety is commonly experienced by patients undergoing coronary artery bypass grafting (CABG), which is also closely related to the recovery of patients. This study aimed to determine effect of stretching combined with a slow deep breathing exercise (S+SDBE) on anxiety of patients after CABG.

Methods: In this randomized clinical trial, 50 eligible patients (aged 45-65 years) were randomly divided into experimental (n=25) and control (n=25) groups. The exercise program was performed by the experimental group in the morning and afternoon for 6 days. The patients in the control group received only routine care from the hospital. The Faces Anxiety Scale was used for assessment of anxiety. Data were analyzed using non-parametric tests at a significant level of 0.05.

Results: Data from 48 patients (35 males and 13 females) were analyzed. The mean age of the patients was 59.66 ± 4.1 years. The mean anxiety scores decreased significantly in the experimental group in the morning and afternoon compared with the control group (P<0.05). The anxiety scores differed significantly between the two groups in the morning of days 5 (P=0.025, effect size d=0.32) and 6 (P=0.017, effect size d=0.34) and in the afternoon of days 4 (P<0.001, effect size d=0.51), 5 (P<<0.001, effect size d=0.53), and 6 (P<<0.001, effect size d=0.61).

Conclusion: Based on the results, S+SDBE can be applied to decrease patients' anxiety after CABG.

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What is current knowledge?

Currently, there is no appropriate care strategy for management of anxiety in patients undergoing coronary artery bypass graft surgery.

What is new here?

Stretching combined with breathing exercises has beneficial effects on anxiety of patients after coronary artery bypass graft surgery.

Introduction

Coronary heart disease is responsible for 85% of deaths worldwide. Coronary artery bypass graft (CABG) surgery is a procedure used to treat coronary heart disease (1). Despite the steady improvement in survival and operative safety, postoperative complications still remain a significant cause of morbidity and mortality after CABG (2). Anxiety is commonly experienced by patients following CABG surgery and closely related to the recovery of patients (3). It is more prevalent in heart surgery than in other surgeries and may increase the risk of postsurgical lesions (e.g. atrial fibrillation), acute myocardial infarction, and mortality (4). Anxiety leads to the hyperreactivity of the hypothalamo-pituitary-adrenal axis, which results in increased blood pressure, increased heart rate, reduced heart rate variability, spasm of the coronary arteries, progression of atherosclerosis, and increased endothelial damage (5).

Studies indicate that non-pharmacological interventions such as psychoeducation (6), foot massage (7), and music therapy (8) may have positive psychological effects on anxiety in patients undergoing CABG surgery. The focus of in-hospital phase (phase I) of physical therapy in patients undergoing cardiac surgery is to avoid physical inactivity and to maintain or improve pulmonary capacities and muscular strength (9). According to previous studies, yoga (10), diaphragmatic breathing relaxation training (11), and muscular relaxation exercises (12) have beneficial effects on anxiety. However, research in this area is limited, and the effect of stretching exercises or a combination of stretching and breathing exercises in post-CABG patients is not determined.

Breathing exercises are a simple strategy to improve lung efficiency and can help to treat of cardiac surgery. The aim of these exercises, at phase I of cardiac rehabilitation, is to reduce the risk of pulmonary complications, functional capacity impairment, and prolonged hospital stay (13). Moreover, previous studies have demonstrated that breathing exercise is effective in reducing anxiety in patients (14, 15). There is limited evidence on the efficacy of stretching exercises for reduction of anxiety (16). Stretching has been reported to alleviate depressive symptoms and improve sleep health (17, 18). To our knowledge, there is no data regarding the effects of stretching exercise on anxiety at the hospital phase. This study is the first to examine the effects of stretching combined with a slow deep breathing exercise (S+SDBE) on anxiety of patients following CABG surgery.

Methods

Participants

This double-blind, randomized controlled clinical trial was conducted on patients who had undergone CABG surgery in Shahid Madani Cardiovascular Hospital of Tabriz, Iran in 2020. Inclusion criteria were age of 45 to 65 years, left ventricular ejection fraction of <40%, the Faces anxiety score of > 2 (19), and no history of heart surgery, neuromuscular and cognitive impairment, severe lung disease, and renal impairment. Exclusion criteria included hemodynamic instability including arrhythmia, cardiogenic shock, postoperative hypotension, and hypertension.

The sample size was calculated considering anxiety as the primary outcome according to a previous study (3). It was determined using G Power analysis, the mean scores of anxieties in experimental (39.25±3.09) and control (45.12±5.26) groups, and estimated effect size of d=1.36. The estimated total sample size for comparison of the means of two independent groups (Mann-Whitney U Test) with an alpha error of 0.01 and power of 0.95 was 44 patients.

Study design

Fifty eligible patients were selected from 69 available patients. The subjects were randomly assigned to experimental (n=25) and control (n=25) groups. The randomization sequence was created using Random Allocation Software and stratified with a 1:1 allocation using random block sizes of 2 and 4. The hiding mechanism was employed by numbered, opaque, and sealed envelopes.

The exercises were performed in the experimental group, and anxiety levels were assessed in both groups for 6 days in the morning and afternoon by a nurse

blinded to the study. Patients in the experimental and control groups were hospitalized in separate rooms and were unaware of the type and difference of the intervention.

Outcome measures

In the present study, the Faces Anxiety Scale (FAS) was used to measure state anxiety in the patients. This is a simple, self-rating, and single-item tool for rapid assessment of state anxiety, which is scored based on a 5-point scale. A higher score represents a higher level of anxiety (20). The scale has been suggested for use in intensive care patients since it is easily administered and imposes minimal burden on the patient. According to studies on the validity of the FAS, this scale is a useful tool for the assessment of the severity of acute [state] anxiety (20-22). A correlation coefficient of 0.70 has been reported for the relationship between the State Anxiety Inventory questionnaire and FAS (22). The validity of FAS has been confirmed in previous studies in Iran (23, 24).

In the present study, anxiety was evaluated in all subjects twice a day (9:00 am; 5:00 pm) before each exercise session, for 6 days.

Interventions

The experimental group performed S+SDBE with routine care twice a day for 6 days, and the control group received only routine hospital care that included medicine administrations, measurement of vital signs, and getting out of bed and walking, with no planned training services.

The experimental group received preoperative education in S+SDBE. The postoperative exercises began in fully conscious patients and an hour after extubation. The S+SDBE training for the intervention group was designed and standardized based on the American College of Sports Medicine (ACSM) recommendations for the prescription of exercises in phase I cardiac rehabilitation (9). According to the ACSM recommendations, intensity of our exercise training was below of resting Heart Rate + 30 bpm. Patients during stretching the muscles, inhaled a deep breath through their nose and during release the muscles, exhaled slowly through their mouth. Additional details regarding the exercises are presented in (table 1).

Statistical analysis

Normal distribution of data was assessed using the Kolmogorov-Smirnov test. Normally distributed data in two independent groups were compared using the student-t- test, and the qualitative data in two independent groups were compared using the Chi-square test. The anxiety scores were compared between the groups using the Mann-Whitney U test. The effect size was estimated using the ($r=z/\sqrt{n}$) formula (25). A P-value of less than 0.05 (typically $\leqslant 0.05$) was considered statistically significant. The statistical analysis of data was done using SPSS 23 statistical software.

Results

Sample characteristics

One patient from each group was excluded from the analysis due to insufficient data (Figure 1). The mean age, body mass index (BMI), preoperative anxiety level, and duration of hospitalization were 59.66 ± 4.1 years, 26.71 ± 3.95 kg/m^2, 2.81 ± 1.4, and 8.62 ± 1.9 days, respectively. There was no significant difference between the groups in terms of demographic characteristics and preoperative clinical variables (P>0.05). In addition, there was no significant difference in the preoperative anxiety score between the study groups (P=0.482) (Table 2).

Comparison of the mean anxiety scores

The anxiety level differed significantly between the study groups in the morning session of days 5 and 6 as well as in the afternoon session of days 4, 5, and 6 (P<0.05).

According to the effect size value, S+SDBE had a large effect in the afternoon of days 4 (effect size =0.51), 5 (effect size =0.53), and 6 (effect size =0.66). We observed a medium effect in the morning of days 5 (effect size =0.34) and 6 (effect size =0.32) and a small effect in the afternoon of days 1–3, as well as in the morning of days 1-4. According to the Cohen's guidelines for effect size, large, medium, and small effect sizes are 0.5, 0.3, and 0.1, respectively (Table 3).

As shown in figure 2, the anxiety scores decreased significantly in the experimental group compared with the control group from the afternoon of day 4. Moreover, the exercise had more prominent effect on anxiety in the afternoon.

Discussion

The present study demonstrated the beneficial effects of S+SDBE on anxiety of patients undergoing CABG surgery. Within 6 days of S+SDBE, anxiety levels decreased significantly in the experimental group compared with the control group in the morning and afternoon sessions. This finding will reinforce the results of previous studies that have demonstrated the benefits of breathing or stretching exercises in reducing anxiety (14-16). With the help of these studies, it is possible to explain the mechanisms through which stretching + breathing exercises affect patients' anxiety. According to reports, muscle stretching is an alternative relaxation training procedure in the clinical population (26). Dehdari et al. have reported that progressive muscular relaxation training can significantly reduce anxiety scores and increase the quality of life domains of patients after CABG (12). It has been shown that slow muscle stretching will produce muscle relaxation and decrease muscle tone, ischemia, and pain (26). Given that anxiety can cause tense muscles (27), stretching can be a straightforward technique to improve joint mobility and reduce muscle tension (28).

It has been found that breathing exercises reduce anxiety symptoms and stabilize the autonomic nervous system. This type of exercise stimulates the parasympathetic nervous system and reduces anxiety levels (11). Chandrababu et al. evaluated the effect of pranayama on anxiety and reported that nostril breathing exercises (pranayama) decrease the anxiety of patients undergoing cardiac surgery (3). Other studies suggested that deep and slow breathing can improve vagal tone, cardiovascular function, and pain tolerance (28). It has been also reported that deep breathing exercises can improve oxygenation and pulmonary function after CABG (29, 30). It is well-established that reduced lung function or breathing discomfort may influence anxiety levels (31).

To our knowledge, no study has yet examined the effects of rehabilitation programs on anxiety throughout the day. In the present study, we investigated the effect of S+SDBE on anxiety levels in the morning and afternoon. The results indicated that anxiety decreased in the experimental group compared with the control group in the mornings of days 5–6. Moreover, a significant difference between the groups was observed in the afternoons of days 4–6. A larger effect size in the afternoons of days 4-6 compared with the mornings indicates more robust relationship between exercise and anxiety in the afternoon. Furthermore, we could say that S+SDBE had a considerable effect on anxiety of patients in the afternoon and a medium effect in the morning.

The anxiety level in the morning and afternoon may be affected by many factors. One of the influential factors in this regard may be family visits to the hospital in the afternoon. Some previous studies have revealed that family visits reduces patients' anxiety level (32, 33). Some stressors such as increased activity, sleeping in a strange bed, insufficient sleep, being away from family members, and pain can also affect patients' anxiety after surgery (34, 35). On the other hand, anxiety in the morning may be due to the doctor's visits in the morning, hospital care in the morning shift, or inadequate sleep at night. However, further studies are required to determine the exact causes of increased patient anxiety in the morning.

The present study was conducted in a teaching hospital, which limits the generalizability of the findings. It is recommended to investigate the effects of S+SDBE on patients undergoing other operative procedures.

Conclusion

Anxiety is a common phenomenon after CABG, and our findings suggest that S+SDBE can be a beneficial intervention for reducing anxiety among patients undergoing CABG surgery. Our results also support the use of non-pharmacological interventions for the relief of anxiety in postoperative nursing care. The exercise intervention has a large effect on anxiety in the afternoon and a medium effect in the morning. Moreover, anxiety levels begin to decrease in the afternoon from day 4. It is recommended to conduct further studies on the effects of S+SDBE on patients undergoing other operative procedures.

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Ethical statement

This study was approved by the Ethics Committee of Tabriz University of Medical Sciences, Tabriz, Iran (ethical code: IR.TBZMED.REC.1399.470) and Iranian Registry of Clinical Trials (ID: IRCT20160523028028N2). Written informed consent was taken from all eligible participants, and the subjects were ensured about the confidentiality of their personal information.

Conflict of interest

The authors declare that they have no competing interests.

Author contributions

Supervision: A Z, N S; Project administration: A Z; Methodology: all authors; analysis and interpretation of data: all authors; Investigation: A Z, L E; Data collection: AZ, LE, BE; writing the original draft: A Z; writing, review, and editing of the manuscript: A Z, N S. All authors read and approved the final manuscript.

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Table 1: Details of S+SDBE training in the experimental group

Exercise	Performance
Day 1 **The patient closed his/her eyes while lying down and performed the finger, hand, wrist, and ankle stretches:** **Flexed their hands forward at the wrist** **Flexed their hands backward at the wrist** **Spread their fingers out** **Flexed their feet up** **Pulled their feet down**	Stretching time: 6 seconds Repetition of each stretch: 3 times Rest between each exercise: 10 seconds Frequency: Twice a day
Day 2 **In the Fowler's position, patients straightened their knees and repeated the stretches of the first day.**	Stretching time: 7 seconds Repetition of each stretch: 3 times Rest between each exercise: 10 seconds Frequency: Twice a day
Day 3 **In the Fowler's position, they repeated the exercises of the first day and performed neck stretches** 1. **Flexion** 2. **Extension** 3. **Right rotation** 4. **Left rotation**	Stretching time: 8 seconds Repetition of each stretch: 3 times Rest between each exercise: 10 seconds Frequency: Twice a day
Day 4 **Patients got out of bed, walked, and performed hand and shoulder stretches:** **1. They placed both hands behind their head with their fingers interlocked and expanded their chest.** **2. They raised their arms and stretched them over the head with fingers interlocked and the palms facing toward the ceiling.**	Stretching time: 9 seconds Repetition of each stretch: 3 times Rest between each exercise: 10 seconds Frequency: Twice a day
Days 5 and 6 **Patients walked high knees as far as they could and repeated the stretches of the fourth day**	Stretching time: 10 seconds Repetition of each stretch: 3 times Rest between each exercise: 10 seconds Frequency: Twice a day

Table 2: Comparison of clinical and demographic characteristics of the patients in the study groups

Clinical and demographic variables	Experimental group	Control group	P-value
Age (years)	58.92±4.7	60.37±3.4	0.228
***Male/female (Number)**	16/8	19/5	0.330
***Married/single (Number)**	24/0	23/1	0.317
***Educational level (Number)**			
Elementary and middle school	12	16	0.440
High school and higher levels	12	8	
BMI (Kg/m^2)	27.53±5.2	25.87±4.7	0.256
Duration of surgery (hours)	3.71±0.4	3.62±0.5	0.550
Duration of hospitalization (days)	8.37±1.8	8.87±2.1	0.373
Systolic blood pressure (mmHg)	151.5±16.2	149.7±15.4	0.669
Diastolic blood pressure (mmHg)	84.58±18.8	87.66±17.2	0.557
Blood sugar (mg/dl)	138.3±63.8	149.5±66.1	0.710
Left ventricular ejection fraction (%)	49.46±6.1	51.96±4.4	0.110
****Preoperative anxiety score**	2.87±1.21	2.74±1.44	0.842
Independent t-test or chi-square test** * Mann-Whitney U test**			

Table 3: Comparison of anxiety scores between the study groups

Groups	Time	Days					
		1	2	3	4	5	6
Experimental	Morning	3.87±1.2	3.83±1.2	3.54±1.1	3.42±1.2	2.75±1.2	2.62±1.1
	Afternoon	2.92±1.0	2.70±.85	2.42±.58	2.33±.48	2.17±.38	2.04±.20
Control	Morning	3.83±1.5	3.75±1.5	3.81±1.4	3.66±1.5	3.62±1.4	3.58±1.4
	Afternoon	3.21±1.3	3.12±1.1	2.87±1.3	3.25±.94	3.04±.99	3.04±.85
P$^{\neq}$		0.966	0.916	0.417	0.541	0.025*	0.017*
Z		-0.042	-0.106	-0.812	-0.611	-2.239	-2.377
Effect size d		0.01	0.02	0.12	0.09	0.32	0.34
P$^{£}$		0.321	0.124	0.083	P<0.001*	P<0.001*	P<0.001*
Z		-0.991	-1.538	-1.733	-3.553	-3.674	-4.573
Effect size d		0.14	0.22	0.25	0.51	0.53	0.66

P≠: the P-value of the Mann-Whitney U test, difference between groups in the morning (9:00 AM)
P£: the P-value of the Mann-Whitney U test, different between groups in the afternoon (5:00 PM)
*statistically significant difference Z-Scores for 95% Confidence Intervals

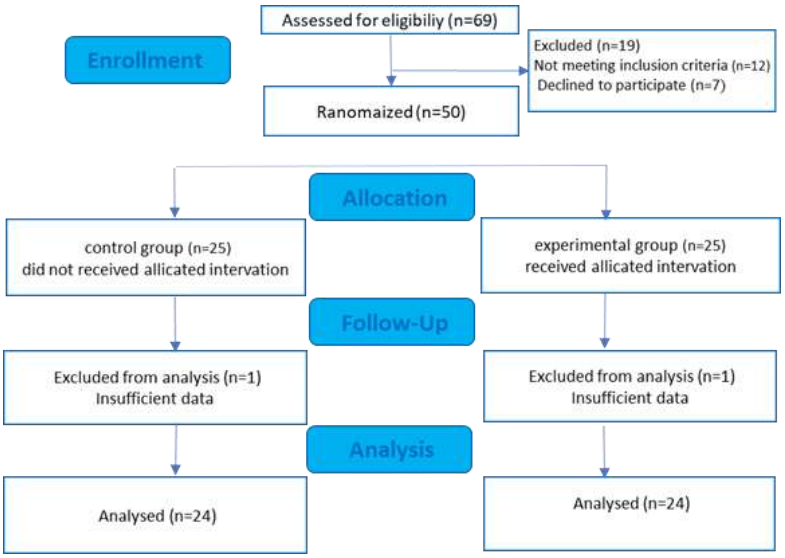

Figure 1. The CONSORT flow diagram

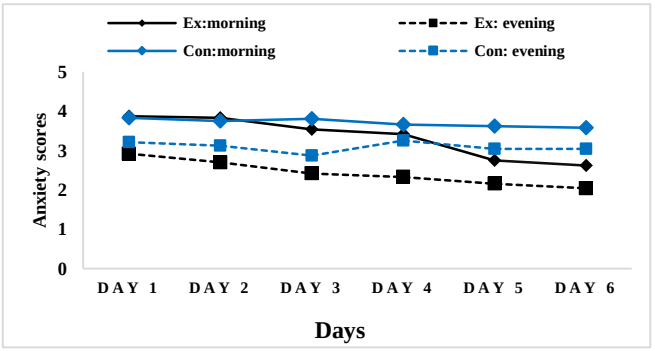

Figure 2. Anxiety scores during 6 days of intervention in the experimental (Ex) and the control (Con) groups in the morning and afternoon

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