



Efficacy of Buteyko Breathing Technique on Anxiety, Depression, and Self-efficacy in Coronary Artery Bypass Graft Surgery Patients: A Protocol for Randomized Clinical Trial

Moli Jain^{a#}, Vishnu Vardhan^{a*†}, Vaishnavi Yadav^{a‡} and Pallavi Harjpal^{b†}

^a Department of Cardio Respiratory Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India.

^b Department of Neuro Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Medical Sciences, Wardha, Maharashtra, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i51A33473

Editor(s):

(1) Dr. Giuseppe Murdaca, University of Genoa, Italy.

Reviewers:

(1) Devangi S. Desai, Pioneer Physiotherapy College, Shri Govind Guru University, India.

(2) M.Rajeswari, Sri Ramachandra Institute of Higher Education and Research, India.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/75931>

Study Protocol

Received 05 September 2021

Accepted 11 November 2021

Published 20 November 2021

ABSTRACT

Background: Annually, more than a lakh CABG procedure is performed in India aiming to restore blood circulation to heart muscles. But psychological factors like anxiety and depression among such patients pre and post-operatively are often overlooked.

Our study aims to incorporate rehabilitation for psychological factors along with Cardiac rehabilitation using the Buteyko breathing technique among such population.

Methods: Total 44 Post CABG patients after enrolment in the study will be divided into 2 groups to evaluate anxiety, depression, and self-efficacy, Conventional group (n=22) which receive in-hospital Cardiac rehabilitation for 2 weeks whereas the other group, the Experimental group (n=22) will receive In-hospital Cardiac rehabilitation along with Buteyko Breathing training.

MPT Student.

† Professor and HOD.

‡ Assistant Professor.

*Corresponding author: E-mail: vishnudiwakarpt@gmail.com;

Discussion: Anchoring rehabilitation for psychological consequences in patients with CABG surgery will play a major role in fostering recovery, decrease the cost of Medicare and ameliorate symptoms. This will pave a path to incorporate the Buteyko breathing technique along with Cardiac rehabilitation as a holistic approach for CABG patients.

Keywords: *Buteyko breathing technique; coronary artery bypass graft surgery; anxiety and depression; self-efficacy; coronary artery disease.*

ABBREVIATIONS

CABG : *Coronary Artery Bypass Graft*
BBT : *Buteyko breathing technique.*
DASS : *Depression, Anxiety and Stress Scale*
BMI : *Body Mass Index*
POD : *Post-Operative Day*
METS : *Metabolic equivalents*
ROM : *Range of Motion*
AACVPR: *American Association of Cardiovascular and Pulmonary Rehabilitation*
B/L : *Bilateral*
UL : *Upper Limb*
LL : *Lower Limb*

1. INTRODUCTION

In India, 1.40 lakh Coronary Artery Bypass Graft (CABG) procedures are conducted yearly. It is a lifesaving procedure to re-vascularize the blocked arteries supplying the heart muscle by either redirecting the blood flow to a different artery [1]. It aims to increase life expectancy by enhancing ventricular function and suppressing further chances of reoccurrence. Besides that, this long-duration lifesaving procedure is linked with psychological complications like mental stress, anxiety, depression, generalized which can be disabling and distressing. Psychological symptoms were reported in about 60% of cases, in which Post-operative depression independently accounts for 23% of cases that are usually associated with graft degradation and exacerbation of symptoms [2,3]. Studies have shown, in between the early 6 months to 5 years post-surgery depression alone is a prognostic factor for delayed functional recovery, frequent hospitalization, and mortality [4,5].

Numerous studies have identified causes for stressors experienced by open-heart surgery patients during their pre and post-surgery hospital course, including the presence of blinders in between beds, nursing staff rushing in a hurry, other patients' deaths, difficulty in sleeping, pain, the presence of endotracheal tubes, drainage tubes, and lines, being away

from home, and unfamiliar environment. Often aetiologies are frequently overlooked/heard causing significant distress and potentially leading to poor consequences [6]. like reduced cardiac symptoms alleviation, more frequent re-hospitalization, [7] delayed healing of incisions, altered physical and mental health, and decrease life expectancy [8,9]. All of these variables contribute to inactive behaviour, less social involvement, poor well-being, and increased Medicare costs.

Acute stress response stimulates the sympathetic nervous system which results in faster breathing in preparation for greater effort and adrenergic drive. Emotional extremes like fear, anxiety, or stress leading to hyperventilation is a common response [10]. Under such circumstances implementation of exercising low volume breathing that aims at altering CO₂ tolerance has been proven to provide curative advantages [11,12] to those suffering from emotional distress [13]. The practice of monitoring, regulating, and slowing down one's breathe while creating a sense of introspection has been found to help people relax and cope better in stressful circumstances. Such efforts cause a little build-up of CO₂ in the brain, allowing it to sustain high levels of the gas. Short-term exposure to the sensation of air hunger will also diminish the body's panic reaction, lowering the likelihood of hyperventilation. Although, the sense of air hunger is a natural occurrence that we encounter several times a day, especially during physical exercise, thus there is no need for the body to respond with fear in reaction to the feeling.

Konstantin Pavlovich Buteyko develops a breathing strategy that is unique of its kind by working on reducing the volume of breathing to create air hunger and the need for oxygen. Besides other breathing techniques which aim to slow down breathing. In effect, the idea operates like a vaccine: decreasing breathing to induce an air hunger is comparable to giving the body a tiny, controlled dosage of symptoms, which can be beneficial for overcoming the dread of the sensations that accompany a full-fledged panic

attack. By resetting the respiratory center, the long-term objective is to restore normal breathing volume. Breathing involving the upper chest, obvious breathing, and frequent sighing are all behaviors that may be readily addressed by retraining the breath and lowering the breathing rate to a more steady range [14]. In CABG patients, breathing, which is one of the most effective and fastest methods to impact the mind, was used in this study, the quickest methods to affect their internal emotional and psychological state concerning their surroundings aid in increasing self-efficacy and fostering a sense of introspection [15].

1.1 Research Hypothesis

This study aims to evaluate the effect of Buteyko breathing technique along with Phase 1 cardiac

Rehabilitation on Anxiety, Depression, and self-efficacy in patients with Coronary Artery Bypass Graft.

1.2 Trial Design

The research design is an assessor and patient blinded randomized clinical trial with two parallel groups for Post CABG patients. The patients will be randomized through simple random sampling and allocated through the sequentially numbered opaque sealed envelope (SNOSE) method into Group A and Group B. Outcome measures will be assessed 1 day before the surgery, the day after the surgery, on their last rehabilitation session, and at the time of follow-up after 2 weeks along with written informed consent before inclusion.

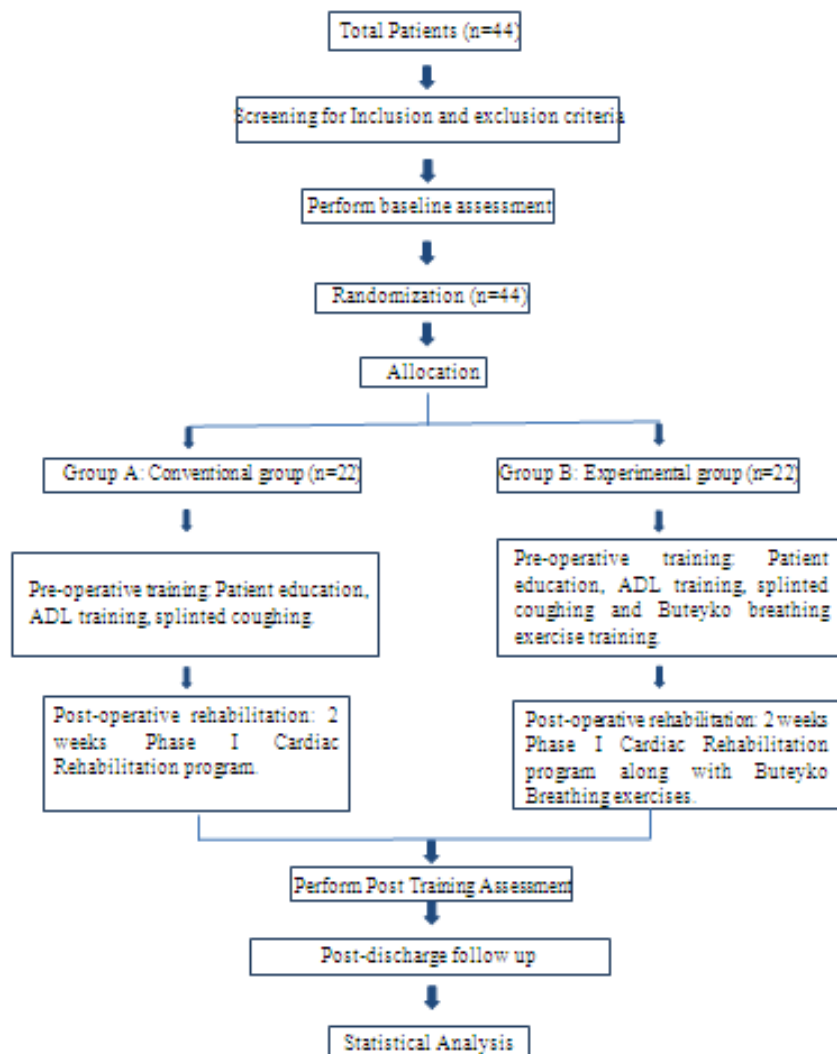


Fig. 1. Study Procedure flow chart

2. METHODOLOGY

2.1 Study Setting

The research will be carried out in the Cardiovascular and Thoracic Surgery Unit, AVBRH, Wardha, Maharashtra.

2.2 Eligibility Criteria

Inclusion criteria for the patients are as under:

1. Both male and female patients undergoing CABG surgery (both on-pump and off-pump surgical procedures).
2. CABG patient after approval for cardiac rehabilitation from Physician.
3. Pre- Operative DASS-42 score for Depression >9 and Anxiety >7
4. CABG patients with BMI <30Kg/m².
5. CABG patients with ages between 40 and 75 years.
6. Patient with the ability to understand and follow instructions.
7. CABG patients willing as well as complaint for the study.

Exclusion criteria for the patients are as under:

1. Obese patients (BMI >30Kg/m²).
2. CABG Patients below 40 and over 75 years of age.
3. Patients who had a history of any complications (e.g. preoperative Myocardial Infarction, Lung Congestion, Post-operative renal failure, patients on Intra-aortic balloon pump, or arrhythmia needed for a pacemaker).
4. CABG patient on Post-operative mechanical ventilation (more than 24 hours).
5. No previous neurological complications in the last 6 months.
6. Post-COVID 19 patients.

2.3 Intervention Design

Pre-operative training:

All patients participating in the study will sign a consent form and attend a Pre-operative Physiotherapy assessment and training. Both groups' baseline outcome measures will be obtained using DASS 42 scale and the General Self efficacy scale. During which both groups will get instructions about the CABG procedure and

the importance of the Phase I Cardiac rehabilitation program along with Bed mobility training, activity of daily living training. Splinted Coughing technique, and breathing exercises. Whereas, patients in Group B will get training for Buteyko Breathing Technique.

Post-operative training and rehabilitation:

Both groups will undergo Post-operative assessment on POD 1. Patients in both groups were given self-management and education handouts, which included relaxation methods to reduce dyspnea, smoking cessation, nutritional guidance, and information and advantages of the rehabilitation program.

Group A: Conventional Group

As per the AACVPR Guidelines, an In-hospital Cardiac rehabilitation program of 2 weeks will be administered after 24 hours once the patient will be weaned off the Mechanical ventilator and hemodynamically stable. As per the Frequency, Intensity, Type, and Time principal exercise prescription will be done. Aerobic exercise involving a large muscle group or walking every 3 to 5 days a week with intensity 3-4 METS for 20 to 30 minutes will be administered.

Level 1: In CVTS ICU Essentially bed rest (1–1.5 METs)

- Patient education about inpatient cardiac rehabilitation program, importance of physical therapy and adherence to exercise regime.
- Bed side exercises and dangling with feet supported.
- Passive range of motion exercises for all major joints except shoulder (5 to 10 reps). along with bilateral ankle toe pumps.
- Deep breathing exercise

Level 2 Sitting—Limited Room Ambulation (1.5–2 METs)

- Bed side sitting 15–30 min, 2–4 times/day and dangling with feet unsupported.
- Splinted coughing.
- Deep breathing exercises (Diaphragmatic and segmental breathing exercises).
- Elevation of bilateral arms till shoulder level (x 5 reps).
- Active ROM exercise for B/L UL and LL except shoulder(x10 reps).

- Initiate standing at the side of bed with assistance.

Level 3: Room—Limited Hall Ambulation (2–2.5 METs)

- Continuing previous exercises
- Shoulder and shoulder girdle exercises, neck exercises, trunk exercises and lower limb exercises like hip, knee and foot exercises (x 10 reps).
- Standing warm-up exercises (Standing knee raise with chair support (x 10 reps), Standing hip abduction and extension with chair support(x 10 reps))
- Walking up to 5 minutes as tolerated 3 to 4 times a day
- Incentive Spirometry

Level 4: Progressive hall ambulation (3 to 4 METs)

- Continuing previous activities with increased duration.
- Ambulation along the hallway without support 8 to 10 minutes 3 to 4 times a day.
- Complete instruction in home exercise program and in energy conservation and pacing techniques.
- Standing trunk exercises.
- Walk up and down two flights of stairs.
- Incentive Spirometry

Group B: Experimental group:

Patients in this group will undergo a Phase I cardiac rehabilitation program along with Buteyko breathing exercise training for 2 weeks.

2.4 Buteyko Breathing Technique

Procedure

Step 1: The “control pause”:

Patient in a relaxed sitting position will ask to take a gentle breath in (2 sec), breath out (3sec) followed by pinching the nose with hands to hold the breath. The therapist will count the no. of seconds the patient can comfortably hold the breath until feels the need to breathe in again. Followed by releasing the nose and continue breathing.

Step 2: Shallow breathing:

The patient will ask to place his/her finger below the nostrils in a horizontal position to monitor the

amount of air flowing in and out during each breath. Then, they will ask for breath in a flicker of air with enough to fill the nostrils. The patient will then ask to breathe out gently onto their finger. They will ask to concentrate on calming his/her breathe by pretending their finger is a feather that should not move while breathing out. Once the warm air reduces patient will begin to need air.

Step 3: Putting steps 1 and 2 together:

- Control pause (Breathe holding).
- Shallow breathing for 2 min.
- Control pause (Breathe holding).
- Shallow breathing for 2 min.
- Control pause (Breathe holding).
- Shallow breathing for 2 min.
- Control pause (Breathe holding).
- Shallow breathing for 2 min.
- Control pause (Breathe holding).

2.5 Statistical Analysis

The SPSS latest version will be used to perform statistical analyses. To compare the group effect, analysis of variance (ANOVA) will be used. If subjects are lost to follow-up, an intention-to-treat analysis will be carried out. Both statistical tests will be conducted with a confidence interval of 95% to evaluate the effect of the two measures.

2.6 Follow Up

All patients will be followed up at 2 weeks after rehabilitation and follow-up record forms will be completed. The time of the last rehabilitation training session will be recorded electronically. If patients drop out of the trial, the reasons for it will be recorded in detail and preserve. Patients lost to follow-up because of any reason will be gotten in touch as soon as possible and will be follow up within 2 weeks.

2.7 Outcomes

1. Both English and Hindi versions of Depression, Anxiety and Stress Scale 42 (DASS 42)

Depression Anxiety and Stress scale (DASS) is a public domain scale consisting of 42 items that can be self-reported by patients. It consists of 3 domains of emotional state anxiety, depression, and stress.

Correlation between Hindi and English version was 0.85 (p<0.001)

- For depression 0.83(p<0.001)
- For anxiety 0.85 (p<0.001)
- For stress 0.80 (p<0.001)

Correlation coefficient between the scales:

- Depression – anxiety r = 0.70
- Depression-stress r = 0.75
- Anxiety-stress r = 0.73

2. Both English and Hindi versions of General Self Efficacy Scale:

The general self-efficacy scale measures the self-perception of self-efficacy. It is a self-reported questionnaire to rate perceived self-efficacy to predict their coping abilities. It consists of 10 items with a score range from 10 to 40.

- Cronbach alpha Coefficient was 0.80.

2.8 Participant Timeline

Each patient enrolled in the study will require to complete 2 weeks of rehabilitation. The evaluations will be performed at baseline 1 day before the surgery, the day after the surgery, at

their last rehabilitation session, and at the time of follow-up after 2 weeks. As shown in Table 1.

2.9 Sample Size Consideration

It is an independent two-group study protocol investigating the effect of BBT on Anxiety, Depression, and self-efficacy following CABG surgery. The sample size is determined by G. Power 3.15 software using data of Sajja (2019) Contemporary trends of Coronary surgeries in India. 44 patients will be enrolled in the study (22 each in both Conventional and Experimental groups). Four additional participants will be recruited to maintain sample size in the event of dropout or problem with data collection. As a conservative estimate (dropout rate = 25%), we presume that 44 subjects will complete the study.

2.10 Recruitment

The Cardiovascular and Thoracic surgeons and Health care practitioners working under DMIMS refer the prospective patients for in-patient rehabilitation. Patients who fulfill the eligibility standards will enrol in the study. Both group's baseline outcome measures will be obtained using DASS 42 Scale and the General Self efficacy scale. Only those patients who have Pre-Operative DASS-42 scores for Depression >9 and Anxiety >7 will undergo randomization.

Table 1. Schedule of enrolment, interventions, and assessments

	Study period					
	Enrolment	Allocation	Post-Allocation			Follow up
TIMEPOINT	-t ₁	0	t ₁	t ₂	t ₃	(t _x)
ENROLLMENT:						
Eligibility screen	X					
Informed consent	X					
Allocation		X				
INTERVENTIONS:						
[Phase I Cardiac rehabilitation			x	x	x	
[Phase I Cardiac rehabilitation along with Buteyko breathing Technique]			x	x	x	
ASSESSMENTS:						
Baseline Variables (DASS 42)	X					x
Outcome Variables: (DASS 42 and GSES)			x	x	x	x

2.11 Allocation

The patients will be randomized in a 1:1 manner using computer-based randomization and allocated using opaque sealed envelopes which will be sequentially numbered. The allocation will be carried out by the principal investigator and patients will be enrolled from the CVTS unit of our institute. It will be a double-blinded randomized clinical trial with two parallel groups for patients with Post CABG surgery.

2.12 Data Collection and Management

Collection of data and reporting will be carried out under the supervision of the chief investigators. Documentation for the analysis will be carefully scrutinized. The Excel spread sheet will be issued to an allocation blinded statistician at the end of the study to perform the required analysis, after which the groups will be unblinded. The trial's data will be stored in a safe, locked storage area with restricted access for later analysis by a biostatistician and the lead researcher.

3. CONCLUSION

Conclusion will be determined from statistical analysis.

CONSENT

After performing, the baseline assessment Principal Investigators will obtain written consent from the patient and one of his/her family members on a printed form with signatures, as well as evidence of confidentiality.

ETHICAL APPROVAL

The research will be conducted in compliance with the Helsinki Declaration.

The study will be conducted after approval from the Institutional Ethical Committee of DMIMSU, DU.

CONFIDENTIALITY

The participant and one of his or her relatives will be informed about the report, and the principal investigator will collect personal information. The confidentiality statement, as well as the signatures of the principal investigator, patient, and two witnesses, will be included on the consent form. If the patient's consent is needed

to reveal any details for the report, the patient's consent will be obtained with full assurance of his confidentiality.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Kaul U, Bhatia V. Perspective on coronary interventions & cardiac surgeries in India. *Indian J Med Res.* 2010;132(5):543–8.
2. Psychiatric disturbances in patients undergoing open-heart surgery | SpringerLink [Internet]. [Cited 2021 Mar 10]. Available:<https://link.springer.com/article/10.1186/s43045-019-0004-9>
3. Orooj M, Moiz JA, Mujaddadi A, Ali MS, Talwar D. Effect of pulmonary rehabilitation in patients with asthma COPD overlap syndrome: A randomized control trial. *Oman Med J.* 2020;35(3):e136.
4. Carney RM, Freedland KE, Steinmeyer B, Blumenthal JA, Berkman LF, Watkins LL, et al. Depression and five year survival following acute myocardial infarction: A prospective study. *J Affect Disord.* 2008;109(1):133–8.
5. Lett HS, Blumenthal JA, Babyak MA, Sherwood A, Strauman T, Robins C, et al. Depression as a risk factor for coronary artery disease: Evidence, mechanisms, and treatment. *Psychosom Med.* 2004;66(3):305–15.
6. Ahmed AF, Khalil NS, Morsy WY. Stressors encountered by patients undergoing open-heart surgery at a Cairo University Hospitals. 9.
7. Anxiety, depression and perceived control in patients having coronary artery bypass grafts - Gallagher - 2009 - Journal of Advanced Nursing - Wiley Online Library [Internet]. [Cited 2021 Mar 12]. Available:<https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2648.2009.05101.x>
8. Nemati MH, Astaneh B. The impact of coronary artery bypass graft surgery on depression and anxiety. *J Cardiovasc Med.* 2011;12(6):401–4.
9. Alizadehsani R, Hosseini MJ, Khosravi A, Khozeimeh F, Roshanzamir M,

- Sarrafadegan N, et al. Non-invasive detection of coronary artery disease in high-risk patients based on the stenosis prediction of separate coronary arteries. *Comput Methods Programs Biomed.* 2018 May 1;162.
10. Nardi AE, Freire RC, Zin WA. Panic disorder and control of breathing. *Respir Physiol Neurobiol.* 2009;167(1):133–43.
 11. Roth WT. Physiological markers for anxiety: Panic disorder and phobias. *Int J Psychophysiol.* 2005;58(2–3):190–8.
 12. Ghordadekar D, Naqvi WM, Sahu A. A case report on impact of physiotherapy rehabilitation on post coronary artery bypass graft. 2020;6.
 13. Tweeddale PM, Rowbottom I, McHardy GJR. Breathing retraining: Effect on anxiety and depression scores in behavioural breathlessness. *J Psychosom Res.* 1994;38(1):11–21.
 14. Breathing Exercises For Anxiety - Buteyko Method [Internet]. [Cited 2021 Mar 13]. Available:<https://buteykoclinic.com/anxiety/>
 15. Efficacy of Buteyko breathing technique on Anxiety, Depression and Self-efficacy in Coronary Artery Bypass Graft Surgery patients: A Randomized Clinical Trial [Internet]; 2021. [Cited 2021 Aug 3]. Available:<https://www.researchsquare.com>

© 2021 Jain et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://www.sdiarticle4.com/review-history/75931>