

## Effect of Short-Term Yoga-Based-Breathing on Peri-Operative Anxiety in Patients Undergoing Cardiac Surgery

### Abstract

**Background:** Peri-operative anxiety in patients scheduled for cardiac surgery is detrimental. This study evaluated the effect of short-term yoga based-breathing with different variations on peri-operative anxiety. **Materials and Methods:** A prospective randomized controlled study was conducted in patients aged 20–60 years scheduled for major cardiac surgery. Patients in Yoga group were trained for yoga based-breathing with different variations for 5 days; no intervention was done in controls. **Results:** We analyzed twenty patients in each group. Anxiety scores measured at baseline, presurgery, and postsurgery were entered as the within-subjects factor; group status was entered as the between-subjects factor in the RMANOVA. Baseline demographics and anxiety scores were comparable. The short-term yoga-based breathing exercise-training program had a statistically significant effect on state ( $F = 13.45, P < 0.0001$ ), Trait ( $F = 13.29, P < 0.0001$ ) and total anxiety scores ( $F = 29.44, P < 0.0001$ ) at different time points for yoga over control group. **Conclusion:** Short-term yoga-based breathing for 5 days lowers presurgery and postsurgery anxiety in patients undergoing cardiac surgery.

**Keywords:** Anxiety disorder, cardiac surgery, pranayama

### Introduction

Patients scheduled for major cardiac surgical procedures experience increased level of anxiety which has been defined as an “unpleasant emotional state characterized by subjective feelings of tension and apprehension.”<sup>[1]</sup> Anxiety contributes to cardiac mortality by activating the autonomic nervous system which increases the incidence of myocardial ischemia and sudden cardiac death.<sup>[2,3]</sup>

Preoperative anxiety is unavoidable and various pharmacological and nonpharmacological techniques of relaxation are advocated; the latter are preferred because the administration of sedatives and anxiolytics leads to impairment of psychomotor function in the early postoperative period.<sup>[4,5]</sup> Long-term yoga training leads to internal awareness and relaxation. This reduces the reactivity of our autonomic system to a stressful situation and buffers the effect of stress hormones.<sup>[6]</sup>

Research highlighting the beneficial effects of short-term yoga exercises on preoperative anxiety levels is lacking.

Chandrababu *et al.*<sup>[7]</sup> demonstrated the benefit of 15 min of pranayama performed for 3 consecutive postoperative days on anxiety and pain scores in patients operated for cardiac pathologies. The main aim of our randomized controlled pilot study was to evaluate the effect of short-term yoga based-breathing with different variations on peri-operative anxiety.

### Materials and Methods

This was a prospective randomized controlled study conducted in the Advanced Cardiac Centre of our tertiary care hospital from October 2016 to October 2017. After Institutional Ethics Committee approval (INT/IEC/2016/2526 dated 19-11-2016), patients aged 20–60 years awaiting elective surgery in the next 5–6 days were recruited and assessed for eligibility. As this was a pilot study no sample size calculation was done and we chose a convenience sample of forty patients. Patients with severe restrictive lung disease, severe obstructive lung disease, heart failure history of smoking, alcohol intake, central nervous system disease, psychiatric disorder,

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Website: [www.ijoy.org.in](http://www.ijoy.org.in)

DOI: 10.4103/ijoy.IJOY\_120\_20

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**How to cite this article:** Azeez AM, Puri GD, Samra T, Singh M. Effect of short-term yoga-based-breathing on peri-operative anxiety in patients undergoing cardiac surgery. *Int J Yoga* 2021;14:163-7.

**Submitted:** 07-Oct-2020 **Revised:** 19-Jan-2021  
**Accepted:** 15-Mar-2021 **Published:** 10-May-2021

patient receiving any new cardiovascular modulating drug during hospitalization were excluded from this study. Thus, as elaborated in the results later 52 were assessed for eligibility out of which 46 patients were recruited to subsequently have forty patients randomized equally in yoga(Y) and control(C) group after written informed consent.

The patients were randomized equally into yoga (Y) and control (C) groups using random number table. Allocation was done using sealed envelope technique. Baseline demographic and clinical parameters were recorded after their allocation. Recruitment was done by AM, random number generation and allocation to the group was done by GDP, data collection were done by TS. Analysis was performed by AM. Thus, the investigators were blinded but patients were aware of the treatment group.

### Group Y (YOGA)

Yoga sessions were held for the patients during their hospitalization in the cardiothoracic and vascular surgery (CTVS) ward in the evening in a dedicated YOGA room for a total duration of 60 min. The patients and their caregivers were made aware about the surgery and anesthesia. A YOGA instructor briefed the patients about the yoga sessions and supervised the performance of the following asana's;

Alternate nostril breathing: (10 min)

Udghit based breathing variation (10 min): The participants were instructed to breathe deeply through nose and during exhalation "AUM" (ॐ) was chanted for as long as their body allowed.

Alternate nostril breathing: (10 min)

Sheetali breathing variation (5 min): Inhaling with mouth opened in "o" shape and exhaling with the nose.

Bhramari/Humming Bee breathing variation (10 min): During exhalation, humming sound was produced for as long as the participant's body allowed. They were instructed not to be stressed. The vibrations generated within the body were felt.

Yog Nidra/Relaxation (15 min): The participants were made to lie down in Shavasana and made to follow the instructions.

Five sessions were conducted over a period of 5 days.

### Group C (Control)

Patients in this group were taken to yoga room but not given yoga training. The patients and their caregivers were made aware about the surgery and anesthesia.

### Measurement of anxiety

Anxiety scores were measured using the State-Trait Anxiety Inventory (STAI). In the study, we recorded the psychophysiological state (state anxiety) and a personality

trait (trait anxiety). State anxiety reflects the psychological and physiological transient reactions directly related to adverse situations in a specific moment. Trait anxiety is a personality trait and therefore, relatively stable over time. Anxiety scores (Spielberger's STAI) were measured at baseline, the day of surgery in the presurgery room and postsurgery after the patient was weaned off mechanical ventilation and breathing spontaneously.

In the operation theater, general anesthesia was administered to all patients and cardiac surgery was performed using cardiopulmonary bypass. Patients were shifted to the postsurgical CTVS intensive care unit (ICU) for mechanical ventilation immediately after surgery was completed.

### Statistical analysis

The statistical analysis was carried out using the IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. Data were explored for outliers, typing errors, and missing values. Quantitative variables were estimated using mean, median, standard deviation, and standard error. Qualitative or categorical variables were described as frequencies and proportions. The normality of data was checked. Means were compared using *t*-test for normally distributed data and Mann-Whitney test for skewed data. Anxiety scores measured at baseline, presurgery, and postsurgery were entered as the within-subjects factor; group status was entered as the between-subjects factor in the RMANOVA. A significance level of  $P < 0.05$  was assumed.

### Results

Fifty-two were assessed for eligibility; six did not meet the inclusion criteria and 46 patients were recruited in the study from the CTVS ward but six patients were subsequently excluded due to lack of adherence to the Yoga sessions (3) and refusal to participate after the first session (3). The remaining forty patients were randomized equally in yoga (Y) and control (C) group [Figure 1].

Baseline demographic characteristics were comparable in both groups [Table 1]. Baseline State, Trait, and Total anxiety scores were also comparable.

Comparison of anxiety scores at different time points (Baseline, presurgery, and postsurgery) for yoga over the control group highlights the fact that there was significant variation between groups and between time points, and the pattern of change with respect to time was significantly different for both groups [Table 2]. Decreased pattern of anxiety scores (state and total anxiety) were observed in the yoga group [Figures 2-4]. A significantly greater reduction of anxiety scores at presurgery and postsurgery was reported in yoga group patients as compared to the control group.

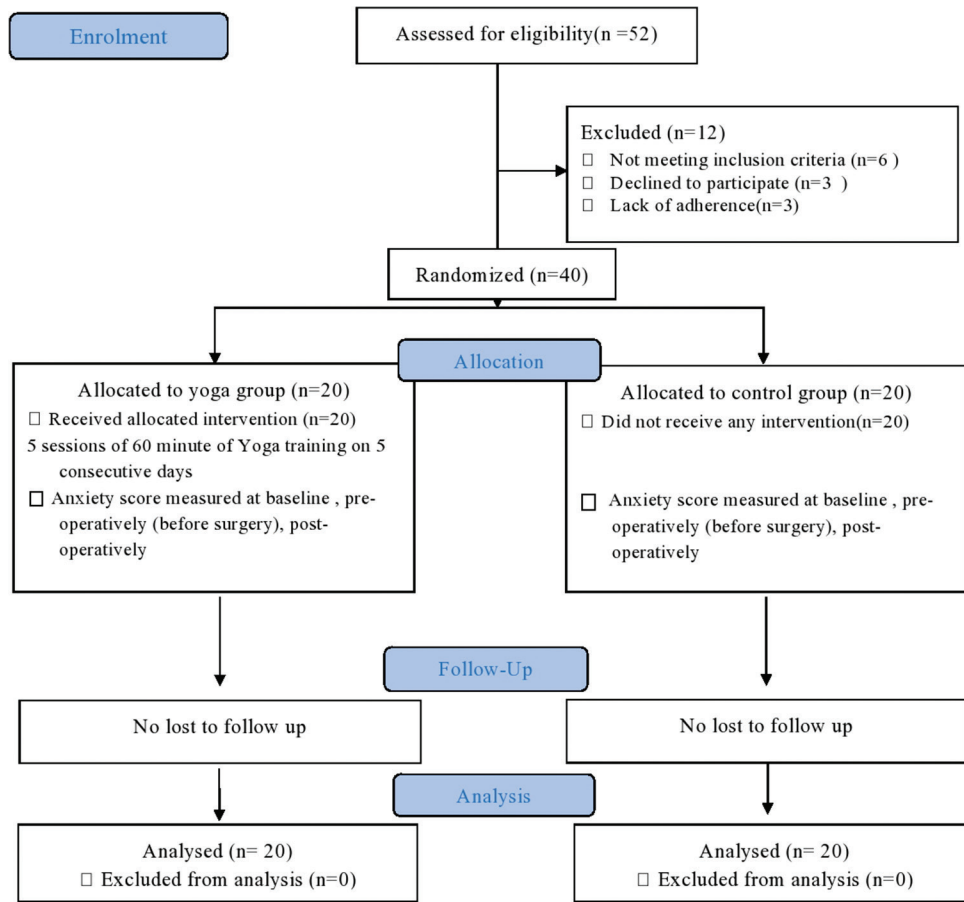


Figure 1: CONSORT flow diagram showing patient's participation

Table 1: Demographic and clinical characteristics of the two groups

Baseline characteristics	Yoga (n=20)	Control (n=20)	P
Gender*, n (%)			
Male	14 (70)	10 (50)	0.197
Female	6 (30)	10 (50)	
Age (years)	50.45±13.25	44.80±14.97	0.214
Weight (kg)	58.00±10.44	56.30±13.38	0.657
Height (cm)	162.05±9.44	162.05±9.28	1.00
BMI (kg/m <sup>2</sup> )	22.15±3.80	21.00±3.64	0.335
NYHA I/II	6/14	8/12	0.50
ASA-PS (2/3)	12/8	11/9	0.74
Trait anxiety score	54.20±4.99	53.60±3.33	0.657
State anxiety score	54.50±5.88	57.55±3.44	0.052
Total anxiety score	108.70±8.69	111.15±6.41	0.317

\*Data expressed as mean±SD for quantitative variables and qualitative data expressed as n (%). P<0.05 considered statistically significant. ASA-PS=American Association of Anesthesiologists-Physical Status, BMI=Body mass index, NYHA=New York Heart Association, SD=Standard deviation

## Discussion

This is the first study to demonstrate the benefit of short-term yoga-based breathing on peri-operative anxiety;

a statistically significant effect on state ( $F = 13.45$ ,  $P < 0.0001$ ), Trait ( $F = 13.29$ ,  $P < 0.0001$ ), and total anxiety scores ( $F = 29.44$ ,  $P < 0.0001$ ) at different time points for yoga over control group was reported after 5 days of intervention. In our study, both the complementary concepts of anxiety, i.e., state and trait were individually evaluated. State anxiety denotes anxiety about an event and is more psychological and physiological in nature. Trait anxiety is a personal characteristic.

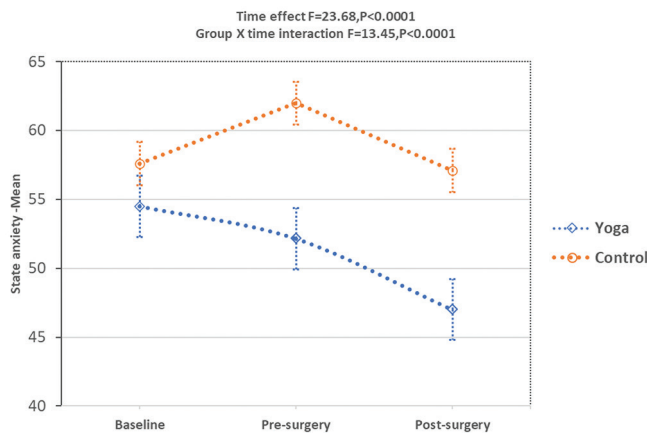
Our results are supported by a previous study in which 15 min of pranayama from 3<sup>rd</sup> to 5<sup>th</sup> postoperative days led to a significant decrease in anxiety ( $P < 0.05$ ) in a similar subset of patients.<sup>[7]</sup> Major differences between the two studies exist in the type and timing of intervention (presurgery vs. postsurgery), study design (nonrandomized in the previous study), duration of the intervention (three consecutive postoperative days for 15 min only versus 5 consecutive preoperative days for 1 h each) and the primary outcome studied. Only presurgery Yoga-based breathing sessions were conducted in our study as the feasibility of postsurgery sessions was limited in this subset of patients by postoperative pain secondary to open cardiac surgery.

Postoperative use of pranayama (5 min) and instrumental music (20 min) for three consecutive days, i.e., day three to

**Table 2: Comparing anxiety scores at different time points (baseline, presurgery, and postsurgery for yoga over control group**

Anxiety	Group	Mean±SD			F statistics		
		Baseline	Presurgery	Postsurgery	F1	F2	F3
State	Yoga	54.5±5.9	52.15±4.1	47.0±3.8	23.68***	50.95***	13.45***
	Control	57.6±3.4	62±4.0	57.1±4.8			
Trait	Yoga	54.2±5.0	50.3±5.6	48.8±4.9	5.19	8.72***	13.29***
	Control	53.6±3.3	54.9±3.2	54.8±3.3			
Total	Yoga	108.7±8.7	102.4±8.6	95.7±6.7	25.37***	28.95***	29.44***
	Control	111.2±6.4	116.8±6.1	111.9±7.3			

\*\*\*P<0.001. Two-way RMANOVA by Huynh-Feldt epsilon. F1=Time effect, F2=Group effect, F3=Group × time interaction effect, SD=Standard deviation, RMANOVA=Repeated measures analysis of variance

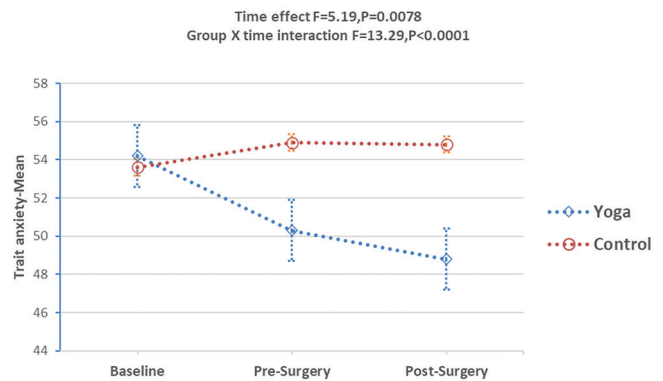


**Figure 2: Line-diagram depiction of state anxiety scores in yoga and control groups at different time points data points represent means and error bars represent standard errors of the means**

day five have been reported to be very effective in reducing the pain and anxiety after cardiac surgery.<sup>[8]</sup> Chandrababu *et al.*<sup>[7]</sup> also administered two different complementary therapies yoga and music and thus the results of his study cannot be compared with ours in which we have only used short-term yoga-based breathing variation.

There is evidence to support the beneficial effect of long-term yoga training on the cardiovascular system; subjects practicing for a duration of 5 years have reported a significant reduction in the pulse rate and blood pressure and a higher Valsalva ratio.<sup>[9]</sup> Evidence on the effectiveness of short-term yoga-based breathing variation in decreasing pre and postsurgery anxiety does not exist. The effectiveness of 5 min of “sukha pranayama” in decreasing the coronary angiography candidates anxiety in a double-blind randomized controlled trial is the shortest intervention period reported till date.<sup>[10]</sup>

The need for nonpharmacological and pharmacological techniques to lower anxiety is emphasized by the results of a cross-sectional study conducted in a tertiary care hospital in our country which reports a very high incidence of preoperative anxiety; 84% in patients scheduled for coronary artery bypass graft surgery.<sup>[11]</sup> Identification of trait scores of anxiety (STAI-T) as a risk factor for long-term



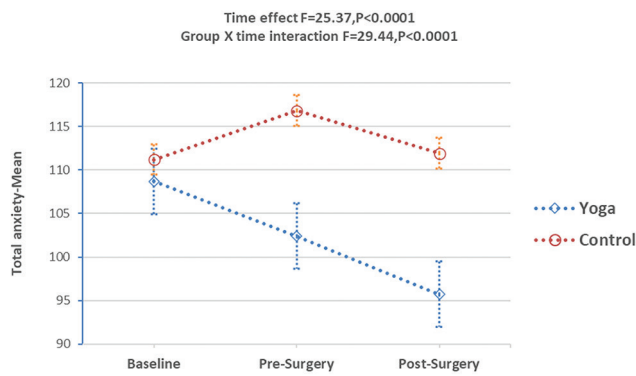
**Figure 3: Line-diagram depiction of trait anxiety scores in yoga and control groups at different time points data points represent means and error bars represent standard errors of the means**

mortality after cardiac surgery in a study with a 7.5 years of follow-up further necessitates the need to minimize the pre and postsurgical anxiety in patients with coronary artery disease to improve patient’s clinical prognosis.<sup>[12]</sup>

Preoperative yoga is a cost-effective and simple intervention that has been effective in decreasing anxiety, stress, symptom severity and improving the quality of life in patients with early-stage breast cancer scheduled for surgery.<sup>[13]</sup> Our study demonstrates the effectiveness of short-term yoga-based breathing variation in decreasing pre- and postsurgery anxiety in patients scheduled for cardiac surgery.

Acute increase in brain GABA levels immediately after a yoga session secondary to stimulation of vagal afferents is the biochemical basis for the improved mood and decreased anxiety.<sup>[14]</sup> Slow breathing (6 breaths/min) increases baroreflex sensitivity, stimulates vagal afferents, and reduces sympathetic activity and chemoreflex activation.<sup>[15]</sup> Other markers of inflammation which have shown a significant improvement with an 8-week yoga-based program in patients with compensated systolic heart failure are interleukin-6 and high sensitivity C-reactive protein.<sup>[16]</sup>

One main limitation of our study was that in the control group we did not do anything and that might have confounded the results of anxiety. The use of meditation,



**Figure 4:** Line-diagram depiction of total anxiety scores in yoga and control groups at different time points data points represent means and error bars represent standard errors of the means

music, etc., in the control group could lead to different results. Learning the skill of yoga is challenging initially. Therefore, an underestimation of the therapeutic effect of yoga-based breathing variation cannot be excluded. Sedative and analgesic drugs are administered during the patients stay in the ICU and thus postsurgery anxiety scores recorded after extubation may be influenced by the drug dosages administered. Yoga exercises fall into three main categories: physical exercises (asana), breath control (pranayama), and thinking (dhyana). Results of our study cannot be extrapolated to the other categories and the therapeutic effects of the other styles of yoga need to be examined in future research studies. Further studies with the inclusion of various biochemical markers will provide a more objective endpoint. We had used a convenience sample and the use of larger samples and longer periods of follow-up will enable us to calculate the exact magnitude of benefit.

## Conclusion

Preoperative short-term (5 days) yoga-based breathing decreases pre- and postsurgery anxiety in patients scheduled for cardiac surgery.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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