

# The Role of Rajyoga Meditation for Modulation of Anxiety and Serum Cortisol in Patients Undergoing Coronary Artery Bypass Surgery: A Prospective Randomized Control Study

## Abstract

**Introduction:** Rajyoga meditation is a form of mind body intervention that is promoted by the Brahma Kumaris World Spiritual University. This form of meditation can be easily performed without rituals or mantras and can be practiced anywhere at any time. The practice of Rajyoga meditation can have beneficial effects on modulating anxiety and cortisol level in patients undergoing major cardiac surgery. **Materials and Methods:** A prospective randomized control study was carried out in a single tertiary care center. One hundred and fifty patients undergoing elective coronary artery bypass surgery were enrolled in the study. The patients were randomized in two groups namely, Group 1 (Rajyoga group) and Group 2 (Control Group). Anxiety was measured on a visual analog scale 1–10 before the start of Rajyoga training or patient counseling (T<sub>1</sub>), on the morning of the day of surgery (T<sub>2</sub>), on the 2<sup>nd</sup> postoperative day (T<sub>3</sub>), and on the 5<sup>th</sup> postoperative day (T<sub>4</sub>). The serum cortisol level was measured in the morning of the day of surgery (T<sub>1</sub>), on the 2<sup>nd</sup> postoperative day (T<sub>2</sub>) and on the 5<sup>th</sup> postoperative day (T<sub>3</sub>), respectively. **Results:** In the study, it was seen that the anxiety level of the patients before the surgery (T<sub>1</sub>) and on the day of surgery (T<sub>2</sub>) were comparable between the two groups. However on the 2<sup>nd</sup> postoperative day (T<sub>3</sub>), the patients who underwent Rajyoga training had lower anxiety level in comparison to the control group ( $3.12 \pm 1.45$  vs.  $6.12 \pm 0.14$ ,  $P < 0.05$ ) and on the 5<sup>th</sup> postoperative day (T<sub>4</sub>) it was seen that Rajyoga practice had resulted in significant decline in anxiety level ( $0.69 \pm 1.1$  vs.  $5.6 \pm 1.38$ ,  $P < 0.05$ ). The serum cortisol level was also favorably modulated by the practice of Rajyoga meditation. **Conclusion:** Mindbody intervention is found to be effective in reducing the anxiety of the patients and modulating the cortisol level in patients undergoing wellknown stressful surgery like coronary artery bypass surgery.

**Keywords:** Anxiety, coronary artery bypass surgery, cortisol, Rajyoga meditation

## Introduction

Meditation is usually defined as a form of mental training that aims to improve an individual's psychological capacities. Meditation encompasses a family of complex practices that include yoga meditation, mindfulness meditation, mantra meditation, tai chi, etc.<sup>[1]</sup> Rajyoga meditation is a form of meditation that is performed without rituals or mantras and can be practiced anywhere at any time. Rajyoga word has been derived from Raja meaning king and yoga meaning union between Soul (spiritual energy) and Supreme Soul (ocean of spiritual energy).<sup>[2]</sup> The role of Yoga meditation is nowadays famous as "Heart Booster." Yoga meditation is increasingly incorporated in life style interventions in coronary artery disease (CAD). The practice of yoga

meditation has documented lowering of blood pressure, heart rate, blood cholesterol, and blood glucose levels.<sup>[3]</sup> Meditation and yoga has also been documented as a very useful tool to quit smoking and tobacco chewing which are risk factor associated with CAD.

Coronary artery bypass grafting (CABG) is by far the most common surgical methods of management in CAD. Undergoing major cardiac surgery is a highly stressful experience for the patients and results in increased levels of anxiety. Stress and anxiety due to fear, pain, or discomfort after major cardiac surgery may have a negative effect which may influence the patient's coping abilities during their recovery and postoperative period.<sup>[4]</sup> There are certain factors that influence anxiety during surgery such as stress related issues,

**Usha Kiran,  
Suruchi Ladha,  
Neeti Makhija,  
Poonam Malhotra  
Kapoor,  
Minati Choudhury,  
Sambhunath Das,  
Parag Gharde,  
Vishwas Malik,  
Balram Airan**

*Department of Cardiac  
Anaesthesia and Surgery,  
Cardiothoracic Centre, All India  
Institute of Medical Sciences,  
New Delhi, India*

## Address for correspondence:

*Dr. Usha Kiran,  
Department of Cardiac  
Anaesthesia, 7<sup>th</sup> Floor,  
Cardiothoracic Centre, All  
India Institute of Medical  
Sciences, Ansari Nagar,  
New Delhi - 110 029, India.  
E-mail: dr\_ukiran@yahoo.com*

## Access this article online

**Website:** www.annals.in

**DOI:** 10.4103/aca.ACA\_32\_17

## Quick Response Code:



This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

**For reprints contact:** reprints@medknow.com

**How to cite this article:** Kiran U, Ladha S, Makhija N, Kapoor PM, Choudhury M, Das S, *et al.* The role of Rajyoga meditation for modulation of anxiety and serum cortisol in patients undergoing coronary artery bypass surgery: A prospective randomized control study. *Ann Card Anaesth* 2017;20:158-62.

outcomes of surgery, pain, complications, and fear of death. Yogic techniques have been found effective in management of anxiety.<sup>[5]</sup> Rajyoga meditation is believed to harmonizes spiritual, mental and physical energy, thereby increasing inner strength to lead a stress-free life.

Although meditation has been practiced for centuries, it is only recently that the effects of meditation have been studied more extensively within the scientific community. The reason for the difficulty in research on meditation is that there are as many unique descriptions of meditation along with the challenges in the methodology of research in meditation. The beneficial role of meditation has been extensively studied in healthy volunteers and very few randomized controlled trail have analyzed the role of yoga meditation in patients undergoing cardiac surgery.

The objective of this study was to evaluate the modulation of perioperative anxiety in patients undergoing CABG by a technique of Mind Body Intervention, named as Rajyoga Meditation. The modulation of blood cortisol levels by Rajyoga Meditation before and after surgery was also evaluated in the study.

## Materials and Methods

After obtaining Institute's Ethics Committee approval and detailed written informed consent, patients having CAD who were scheduled for elective coronary artery bypass surgery were enrolled in this prospective randomized control study. Patients undergoing combined CABG and valve surgery, emergency CABG, re-do surgery, patients having neuropsychiatric illness and those having left ventricle ejection fraction below 35% were excluded from the study. One hundred and fifty patients who met the study criteria were included in the study. Patients were admitted 24–48 h before surgery and were randomized into two groups by sealed envelope technique. The two groups were defined as follows:

### Group 1 (Rajyoga group)

In this group, Rajyoga training was given to the patients before undergoing surgery [Figure 1]. Three basic lessons



Figure 1: Rajyoga meditation training being provided to the patient

for Rajyoga training and practice were given at the time of admission in the hospital. At the same time, the care takers of the patients were also given the same training and they were advised certain instructions to be followed. The patients were advised to practice Rajyoga Meditation in three short sessions of half an hour each. They were instructed to meditate three times in a day before breakfast, before lunch, and before dinner at least for 10 min each.

### Group 2 (Control group)

The patients in this group did not receive any such type of Rajyoga Mediation training. However, in this group, the patients and their care takers were counseled in the same room and were made aware about the surgery and anesthesia.

The Rajyoga Meditation was given in dim light room in the hospital setup meant for the purpose of teaching meditation. Rajyoga Meditation training was given as three basic lessons as per the standard technique of Rajyoga Education and Research Foundation of medical wing of Brahma Kumaris World Spiritual University, Mount Abu, India. The three session included the following training:

- Session 1: Self-realization and self-confidence and self-improvement by positive and genuine thinking resulting in high self esteem
- Session 2: Charging the self (mind and intellect) by Supreme power
- Session 3: Positive and purposeful attitude self-awareness and self-empowerment.

Anxiety was measured on a visual analog scale (1–10) which was explained to the patient at the time of training. The anxiety was measured at four time points, namely before the start of Rajyoga training or patient counseling (T1), on the morning of the day of surgery (T2), on the 2<sup>nd</sup> postoperative day (T3) and on the 5<sup>th</sup> postoperative day (T4). The plasma cortisol level was measured in the morning of the day of surgery (T1), on the 2<sup>nd</sup> postoperative day (T2), and on the 5<sup>th</sup> postoperative day (T3), respectively. To measure cortisol levels, 4 ml of blood was collected at 8 am and was centrifuged to separate out plasma. Cortisol levels were measured by ELISA technique.

Standard institutional protocol of premedication, anesthesia management, and postoperative critical care and pain management were followed in all the cases. As this was an interventional study, the participants and trainers could not be blinded; however, the team who did the laboratory assessments and the statistician were blind to the source of the data.

### Statistical analysis

The data were entered in Microsoft Excel Format (Microsoft, Edmond, RA, USA) and statistical calculations were performed using SPSS version 17.0 (SPSS, Inc., Chicago, IL, USA). The differences between the patients with or without Rajyoga training were analyzed by

univariate analysis. Continuous variables were compared using Student's *t*-test. *P* values <0.05 were considered statistically significant.

## Results

One hundred and fifty patients who participated in the study were randomized into Rajyoga group and control group. Two patients in the Rajyoga group could not complete the study as they required prolonged ventilation and tracheostomy due to chest consolidation and one patient in the control group was excluded as the patient developed renal failure requiring dialysis. The demographic data of the patient in the two groups is shown in Table 1. The mean age of the patients in both the groups was comparable ( $55.82 \pm 5.04$  years vs.  $54.92 \pm 6.83$ ,  $P > 0.05$ ) and the sex distribution was also similar [Table 1].

In the study, it was seen that the technique of Rajyoga meditation was easy and acceptable to the patients and the patients were compliant to this technique of meditation. In this study, it was seen that the anxiety level of the patients before the surgery ( $T_1$ ) were comparable between the Rajyoga and the control group ( $7.10 \pm 0.8$  vs.  $6.87 \pm 0.68$ ,  $P > 0.05$ ). On the day of surgery also ( $T_2$ ), the anxiety levels were comparable between the two groups ( $6.72 \pm 1.05$  vs.  $6.37 \pm 1.31$ ,  $P > 0.05$ ). However, on the 2<sup>nd</sup> postoperative day ( $T_3$ ), the patients who underwent Rajyoga training had statistically lower anxiety level measured on the VAS scale in comparison to the control group ( $3.12 \pm 1.45$  vs.  $6.12 \pm 0.14$ ,  $P < 0.05$ ). Further, on the 5<sup>th</sup> postoperative day ( $T_4$ ), it was seen that patients continuing to practice Rajyoga had further statistically significant decline in their anxiety level ( $0.69 \pm 1.1$  vs.  $5.6 \pm 1.38$ ,  $P < 0.05$ ). Most of the patients also accepted that they had better temperament following meditation [Table 2].

The blood cortisol level which were measured in morning on the day of surgery ( $T_1$ ) were comparable in both the groups ( $10.21 \pm 1.92$   $\mu\text{m/dl}$  vs.  $11.11 \pm 3.01$   $\mu\text{m/dl}$ ,  $P > 0.05$ ). On the 1<sup>st</sup> postoperative day ( $T_2$ ), it was seen that there was an increase in the cortisol level in both the groups. However, the patients in the Rajyoga group had a lower increase in cortisol in comparison to the control ( $13.86 \pm 1.72$   $\mu\text{m/dl}$  vs.  $17.64 \pm 3.23$   $\mu\text{m/dl}$ ,  $P < 0.05$ ). On the 5<sup>th</sup> postoperative day ( $T_3$ ) the blood cortisol level decreased in comparison to the 1<sup>st</sup> postoperative day. It was seen that the patients in the control group had lower cortisol level in comparison to the patients in the Rajyoga group ( $8.56 \pm 1.38$   $\mu\text{m/dl}$  vs.  $6.37 \pm 2.42$   $\mu\text{m/dl}$ ,  $P < 0.05$ ) [Table 3].

## Discussion

Complementary therapies or alternative medicines are used as adjuvant therapy alongside the conventional medical management to enhance overall health and well-being of the patients.<sup>[6]</sup> Examples of these therapies

**Table 1: Demographic variables of the patients in the two groups**

Variable	Rajyoga group (n=73)	Control group (n=74)	P
Age (years)	55.82±5.04	54.92±6.83	0.126
Sex (male:female)	55:18	58:16	0.56

Values are expressed mean±SD or number;  $P \leq 0.05$  is considered significant. *P* value represents the comparison between the Rajyoga group outcome and control group. SD: Standard deviation

**Table 2: Anxiety visual analog scale score of the patients in the two groups**

Anxiety (VAS score)	Rajyoga group (n=73)	Control group (n=74)	P
$T_1$	7.10±0.8	6.87±0.68	0.06
$T_2$	6.72±1.05	6.37±1.31	0.08
$T_3$	3.12±1.45	6.12±0.14	<0.001*
$T_4$	0.69±1.1	5.6±1.38	<0.001*

Values are expressed mean±SD or number;  $*P \leq 0.05$  is considered significant. *P* value represents the comparison between the Rajyoga group outcome and control group. SD: Standard deviation, VAS: Visual analog scale

**Table 3: Blood cortisol level of the patients in the two groups**

Blood cortisol ( $\mu\text{g/dl}$ )	Rajyoga group (n=73)	Control group (n=74)	P
$T_1$	10.21±1.92	11.11±3.01	0.06
$T_2$	13.86±1.72	17.64±3.23	<0.001*
$T_3$	8.56±1.38	6.37±2.42	<0.001*

Values are expressed mean±SD or number;  $*P \leq 0.05$  is considered significant. *P* value represents the comparison between the Rajyoga group outcome and control group. SD: Standard deviation

include yoga, massage therapy, progressive muscle relaxation, acupuncture, acupressure, reflexology, aromatherapy, music therapy, guided imagery, and meditation. Normally drugs are administered to manage anxiety during pre- and post-operative period, but growing research evidence shows the importance of complementary therapies in the postoperative period. These therapies are practiced to minimize anxiety, headache, pain duration of hospital stay, use of sedative drugs and to promote relaxation, sleep, satisfaction and well-being of the patient.<sup>[7,8]</sup>

The most beneficial complementary and alternative therapy is Yoga-Meditation. Meditation improves psychological well-being, self-confidence, relieves stress, facilitates positive experience, reduces pain perception, improves sleep, headache and vomiting which are common features of postoperative recovery phase. Potential effectiveness of meditation has been recognized for relieving the preoperative, anxiety and fear of surgery but not much research has been done on the anxiety and stress relief in adult patients undergoing major cardiac surgery.

In this study, it was found that the Rajyoga Meditation training program conducted in the preoperative period helps in relieving the anxiety of open heart surgery. The addition of Rajyoga meditation helped the patient in coping with the stress, especially after cardiac surgery and it was found that there was a significant decline in anxiety levels on the 5<sup>th</sup> postoperative day. The patients in the control group continued to remain anxious regarding their surgery, its outcome and future quality of life. Premedication before cardiac surgery is effective in reducing anxiety in the immediate preoperative period; however, in this study, it was observed that in the postoperative period there is increase in anxiety and most patients request for attention and this may be effectively modulated by meditation.

Neuroimaging studies have shown that meditation results in an activation of the prefrontal cortex, activation of the thalamus and the inhibitory thalamic reticular nucleus and a resultant functional differentiation of the parietal lobe.<sup>[9]</sup> Meditation induced neurochemical changes can produce an anxiolytic effect. The factors decreasing anxiety during meditation are increased parasympathetic activity, decreased locus ceruleus firing with decreased noradrenaline, increased GABAergic drive and increased serotonin and decreased levels of the stress hormone cortisol. The increased levels of endorphins and arginine-vasopressin (AVP) also contribute to the anxiolytic effects of meditation.<sup>[9]</sup>

Cortisol is the main adrenal glucocorticoid and plays a central role in glucose metabolism and in the body's response to stress. Cortisol is frequently referred to as the "stress hormone" because it is also secreted in higher levels during the body's fight or flight response to stress.<sup>[10]</sup> Cortisol homeostasis is important for cognitive and affective functions that depend on cortisolsensitive brain regions including the hippocampus and prefrontal cortex. Lau *et al.* have showed that meditation training induces changes in the brain.<sup>[11]</sup> There have been reports showing that mindfulness training, for example, in the form of meditation practice, modulates cortisol levels in healthy subjects and cancer patients, plausibly through enhanced executive control promoted by nonjudgmental awareness of experiences in the present moment cultivated during the practice.

In our study, it was found that the preoperative cortisol level were comparable in both the groups. The stress of cardiac surgery resulted in increased release of cortisol on the 2<sup>nd</sup> postoperative day. The patients practicing Rajyoga also had increased level of blood cortisol on the 2<sup>nd</sup> postoperative day; however, the increase was significantly less in comparison to the control group. On the 5<sup>th</sup> postoperative day, the resolution of the stress in the Rajyoga group typically caused the cortisol levels to return to normal range. Creswell *et al.* have also found that brief period of mindfulness meditation training alters psychological and neuroendocrine responses to stress.<sup>[7]</sup>

Similar to the results of our study, Turakitwanakan *et al.* have also reported that mindfulness meditation lowers the cortisol levels in the blood suggesting that it can lower stress.<sup>[12]</sup> Gainey *et al.* have reported that meditation reduced glycated hemoglobin, and cortisol level in diabetic patients.<sup>[13]</sup> In our study, on the 5<sup>th</sup> postoperative day the patients in the control group however had cortisol level below the normal reference range in comparison to the Rajyoga group patient. One possible explanation to the development of lower plasma cortisol levels may be due to the low self-esteem and passive attitude toward life observed in the control group despite being anxious to the outcomes of the surgery. Horn *et al.* have suggested that the low cortisol level in patients with stress may be attributed to emotional numbing symptomatology.<sup>[14]</sup> Yehuda *et al.* have also found low cortisol excretion in patients with posttraumatic stress disorder.<sup>[15]</sup> The changes in peripheral cortisol levels under stress conditions have important implications on the functioning of neural structures, including the hippocampus, which likely actively retrieves past experiences, anticipates future events, and regulates our mind-wandering activity.<sup>[9]</sup> However, the direct effect of training-induced changes in baseline peripheral cortisol levels is still controversial.

## Conclusion

Mind body intervention in the form of Rajyoga Meditation, is a simple technique which provides basic training of the mind in three short session and can be easily practiced by the patients before undergoing cardiac surgery. The practice of Rajyoga Meditation is found to be effective in reducing the anxiety and favorably modulating the serum cortisol level of the patients undergoing CABG.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

## References

1. Ospina MB, Bond K, Karkhaneh M, Tjosvold L, Vandermeer B, Liang Y, *et al.* Meditation practices for health: State of the research. *Evid Rep Technol Assess (Full Rep)* 2007;155:1-263.
2. Telles S, Desiraju T. Autonomic changes in Brahmakumaris Raja yoga meditation. *Int J Psychophysiol* 1993;15:147-52.
3. Gupta SK, Sawhney RC, Rai L, Chavan VD, Dani S, Arora RC, *et al.* Regression of coronary atherosclerosis through healthy lifestyle in coronary artery disease patients – Mount Abu Open Heart Trial. *Indian Heart J* 2011;63:461-9.
4. Gonzales EA, Ledesma RJ, McAllister DJ, Perry SM, Dyer CA, Maye JP. Effects of guided imagery on postoperative outcomes in patients undergoing same-day surgical procedures: A randomized, single-blind study. *AANA J* 2010;78:181-8.
5. Robert-McComb JJ, Cisneros A, Tacón A, Panike R, Norman R, Qian XP, *et al.* The effects of mindfulness-based movement on parameters of stress. *Int J Yoga Therap* 2015;25:79-88.

6. Hart J. Complementary therapies before and after surgery. *Altern Complement Ther* 2009;15:184-8.
7. Creswell JD, Pacilio LE, Lindsay EK, Brown KW. Brief mindfulness meditation training alters psychological and neuroendocrine responses to social evaluative stress. *Psychoneuroendocrinology* 2014;44:1-12.
8. Kiran U, Behari M, Venugopal P, Vivekanandhan S, Pandey R. The effect of autogenic relaxation on chronic tension headache and in modulating cortisol response. *Indian J Anaesth* 2005;49:474-8.
9. Tang YY, Hölzel BK, Posner MI. The neuroscience of mindfulness meditation. *Nat Rev Neurosci* 2015;16:213-25.
10. Yehuda R. Stress and glucocorticoid. *Science* 1997;275:1662-3.
11. Lau WK, Leung MK, Chan CC, Wong SS, Lee TM. Can the neural-cortisol association be moderated by experience-induced changes in awareness? *Sci Rep* 2015;5:16620.
12. Turakitwanakan W, Mekseepralard C, Busarakumtragul P. Effects of mindfulness meditation on serum cortisol of medical students. *J Med Assoc Thai* 2013;96 Suppl 1:S90-5.
13. Gainey A, Himathongkam T, Tanaka H, Suksom D. Effects of Buddhist walking meditation on glycemic control and vascular function in patients with type 2 diabetes. *Complement Ther Med* 2016;26:92-7.
14. Horn CA, Pietrzak RH, Corsi-Travali S, Neumeister A. Linking plasma cortisol levels to phenotypic heterogeneity of posttraumatic stress symptomatology. *Psychoneuroendocrinology* 2014;39:88-93.
15. Yehuda R, Kahana B, Binder-Brynes K, Southwick SM, Mason JW, Giller EL. Low urinary cortisol excretion in Holocaust survivors with posttraumatic stress disorder. *Am J Psychiatry* 1995;152:982-6.

*Welcome to the ACA blog  
at [blog.annals.in](http://blog.annals.in)*

