Section: Anaesthesiology

Original Research Article

A RANDOMISED CONTROLLED TRIAL TO FIND OUT THE COMPLEMENTARY EFFECT OF SAVASANA ON DEPTH OF ANAESTHESIA DURING INTUBATION AS MEASURED BY PATIENT STATE INDEX IN PATIENTS UNDERGOING HEAD AND NECK SURGERIES

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Abstract

Background: The stress response to surgery consists of neuroendocrine and inflammatory components. Perioperative care should attenuate this response using anaesthetic techniques and drugs. Yoga can reduce neuroendocrine responses by optimising autonomic nervous system parameters such as heart rate, pulse rate, blood pressure, and respiratory rate. This study aimed to determine whether a non-pharmacological intervention such as Savasana, a yogic exercise, can help reduce stress due to anaesthesia in patients undergoing surgery under general anesthesia. **Methods:** This prospective, interventional, randomised controlled study was conducted at the Govt Vellore Medical College & Hospital. Patients willing to participate in the study were randomly allocated to two groups. Group R (n=15) patients received routine standard of care for general anaesthesia, while Group S (n=15) patients along with the routine standard of care were connected to headphones to hear the savasana recitation while general anaesthesia was administered. Both patients were connected to the MASIMO SEDLINE monitor using EEG to find PSI(Patient State Index) values during the various steps of anaesthesia. **Results:** In the post-induction stage, the differences between the two groups were significant ($p < 0.0001$). The PSI values in the awake, post-premedication, post-intubation, and recovery stages were not significantly different between the case and control groups. There were no significant differences between the case and control groups regarding the heart rate and diastolic blood pressure scores. In terms of sex, there was no significant difference between the case and control groups ($p = 0.715$). **Conclusion:** Savasana is a cost-effective non-pharmacological intervention that can complement the effects of drugs used to attenuate the stress response due to general anesthesia.

INTRODUCTION

Anesthesia and Surgery elicit a higher degree of surgical stress response in the form of neuroendocrine-metabolic and inflammatory-immune responses, leading to major postoperative complications.[1] The stress response is caused by the increased sympathetic tone and its physiological sequelae.[2] The undesirable sequelae of anesthesia and surgery, such as pain, fatigue, depression, and prolonged recovery, occur frequently in frail patients. They develop due to a maladaptive response to surgical stress, which includes alterations in metabolic and physiological processes that induce many inflammatory, acute, hormonal, and genomic responses. Hypermetabolism and hypercatabolism lead to muscle wasting, impaired immune function and wound healing, organ failure, and death.[3]

In some patients, surgical stress is amplified, causing a wide range of detrimental effects. It activates the sympathetic nervous system, increasing the heart rate, blood pressure, and stress hormone release. This can result in increased oxygen demand, impaired immune function, and altered coagulation, all contributing to complications during and after surgery. The surgical stress response has been linked to the development of postoperative pain, delayed wound healing, and increased risk of infection.

Among the many factors that can influence the stress response to surgery, preoperative factors, such as psychological stress, anxiety, and fear, can significantly reduce tolerance to pain and stress. Psychological stress occurs when a person's ability to “cope with” is jeopardised. Stimuli are passed to the limbic system and then to the posterior hypothalamus.

In order to decrease anxiety, preoperative educational conversations about the surgery, analgesia, postoperative course, and prognosis are provided to the patient. Appropriate premedication therapy using anxiolytics such as benzodiazepines can be used to reduce fear and anxiety. In addition, pre-emptive analgesia using painkillers can be used to reduce nociceptive triggering of the stress response. Beta-blockers and alpha-agonists like clonidine and dexmedetomidine can suppress the surgical induction of catecholamines.[4]

The primary goal of anaesthesia is to provide optimum conditions for reducing surgical stress. However, anaesthetic interventions, such as intubation, can add to the surgical stress response. Maintaining a deep plane of anaesthesia using drugs can reduce the exaggerated stress response. The various drugs available to reduce this stress response are not without complications or side effects. Hence, non-pharmacological measures to reduce stress due to anaesthesia and surgery have been of interest to researchers for many years.

This study hypothesised that corpse-pose yoga could complement anaesthetic drugs to attenuate the stress response. Savasana (corpse pose) is conscious relaxation of the body that can calm the mind and the body. It is usually practised after a strenuous yoga session to relax the body. The benefits of savasana are calming the sympathetic nervous system, reducing or eliminating feelings of stress, improving emotional stability, decreasing anxiety, decreasing muscular tension, improving sleep, increasing serotonin levels, decreasing heart rate and blood pressure and decreasing cortisol levels.[5]

Various yoga teachers consider Savasana as an excellent relaxing technique and emphasise the importance of a 10-minute Savasana practice. It is said that around the sixth minute, one's mental status was profoundly shifting[6] from an active state to a relaxed state. In our study, we used an audio recording in Tamil language as an intervention which was 11 minutes long. This recital was done by an experienced yoga teacher narrating the steps to be followed while the patient lies supine. Overhead phones were used in both groups to cancel all surrounding noises .In the Savasana group at the fifth minute of the recital the anaesthetic procedure was started so that adequate time was given for Savasana to exert its relaxing effect on the patient before intubation was attempted.

The patient state index (PSI) is a parameter used to clinically validate the depth of consciousness. It is calculated via a proprietary algorithm using a high-resolution 4-channel electroencephalograph (EEG) monitor (MASIMO RD SEDLINE) after advanced artefact rejection. The PSI was designed specifically for intra-operative and intensive care use, to monitor patient sedation and drug effects.[7] In this study, this monitor was used to measure the state of consciousness objectively while patients were undergoing general anesthesia.

Hence we hypothesised that preoperative Savasana can help calm the patients, thereby reducing the unfavourable neuroendocrine stress response caused by intubation during general anesthesia for head and neck surgeries, as measured by PSI.

MATERIALS AND METHODS

This prospective, interventional, randomised controlled study was conducted at the Govt Vellore Medical College & Hospital after getting ethical committee approval.

Inclusion Criteria

All consenting and Tamil-speaking patients aged between 20 and 65 years, belonging to the American Society of Anesthesiologists (ASA) Physical Status I and II, who were scheduled for elective head and neck surgeries under general anaesthesia, were included in the study.

Exclusion Criteria

Patients with hearing and psychosomatic problems with difficulty understanding Savasana and those requiring more than one attempt for intubation were excluded from the study.

Patients were assessed preoperatively, and written informed consent was obtained. The patients were randomly allocated to two groups based on computer-generated numbers. Group R patients received the routine standard of care for general anaesthesia which was followed in the institution. Group S patients were taught Savasana with the help of a pre-recorded audio in Tamil recited by a yoga master one day before the surgery.

On the day of surgery, patients were shifted to the theatre, where they were connected to monitor and baseline vital signs, such as heart rate, blood pressure, electrocardiogram, and temperature were recorded. An intravenous line was started, and one pint of Ringer's lactate was started at 100 ml/hr. In addition to routine monitors, all patients were connected via EEG sensors placed on the forehead after cleaning the forehead with alcohol wipes to Masimo Sedline monitor to measure the Patient State Index (PSI) values.

Subsequently, both groups of patients were connected to headphones. Group S was connected to Savasana audio, whereas Group R was connected to soft instrumental music as a placebo. After five minutes, the patients were administered routine drugs for general anaesthesia. Patients in both groups were premedicated with Inj

Glycopyrrolate 0.2 mg IV, Inj Midazolam 1 mg IV, and Inj Fentanyl 2mcg /kg. Induction of anaesthesia was performed with Inj Propofol 2 mg/kg IV followed by Inj Atracurium 0.5 mg/kg to facilitate intubation. Patients with unanticipated difficult intubation requiring more than one intubation attempt were excluded from the study.

PSI values were recorded before general anaesthesia (baseline), after premedication, after induction, and after intubation. Simultaneously, heart rate and blood pressure were recorded. After intubation, bilateral air entry was checked for endotracheal tube placement, confirmed by $EtCO_2$, and recorded on the MASIMO RD SEDLINE monitor. Anaesthesia was maintained with oxygen, nitrous oxide, and sevoflurane, which were titrated according to PSI values between 25 and 50 and also based on haemodynamic parameters. The PSI values were recorded as baseline when awake, after premedication, after induction, and after intubation. The recorded values were recorded and analysed statistically.

At the end of the surgery, the neuromuscular blockade was reversed, and the patient was extubated after adequate clinical recovery. The patients were transferred to the recovery room, and after half an hour, the patients' experiences were discussed, and the responses were recorded for further statistical analysis. The team members involved in the randomisation of the patients to the two groups and the assessor who recorded the intraoperative values were unaware of the group to which the participants belonged.

Statistical Analysis

Data are presented as mean, standard deviation, frequency, and percentage. Continuous variables were compared using an independent-sample t-test. Categorical variables were compared using Pearson's chi-square test. Significance was defined as p-values less than 0.05 using a two-tailed test. Data analysis was performed using IBM-SPSS version 21.0 (IBM-SPSS Corp., Armonk, NY, USA).

RESULTS

There were significant differences between the case and control groups. For instance, the mean PSI scores for the case group were significantly lower than those of the control group in all four categories (awake, post-premed, post-induction, and post-intubation), with p-values of 0.266, 0.742, <0.0001, and 0.04, respectively.

Similarly, the mean SBP scores for the case group were significantly higher than those of the control group in all four categories (SBP1, SBP2, SBP3, and SBP4), with p-values of 0.615, 0.66, <0.0001, and 0.001, respectively. However, there were no significant differences between the case and control groups regarding the HR and DBP scores, with p-values ranging from 0.076 to 0.894. [Table 1] In terms of sex, there was no significant difference between the case and control groups (p = 0.715).

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Table 1: PSI, heart rate, SBP, and DBP between the groups

		Case	Control
PSI	Awake	98.73	99.6
	Post-premed	75.87	76.73
	Post induction	21.6	53.73
	Post intubation	29.47	41.6
Heart rate	HR1	73.53	80.13
	HR2	86.67	93.53
	HR3	83.33	86.2
	HR4	87.33	88
SBP	SBP1	115.33	117.33
	SBP2	124	121.73
	SBP3	126	108.47
	SBP4	142.07	125.2
DBP	DBP1	73.53	79.07
	DBP2	81	78.13
	DBP3	74.67	74.6
	DBP4	89.4	88.8

Patient satisfaction was recorded in the Savasana group as follows

Useful	Not useful	Can't say
7	3	5

It was found that the majority of the patients in the Savasana group felt good.However, it is important to note that this study had a relatively small sample size; therefore the results should be interpreted cautiously.

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DISCUSSION

Many yoga practitioners regard Savasana as an exercise that helps cool down after an intense workout. Savasana also creates a sense of calmness, which helps reduce anxiety and stress. This may help lower high blood pressure from headaches, stress, and insomnia. It may help improve physical and emotional well-being, as it deeply refreshes the thoughts, keeping the body physically still.[8] Since the preoperative period puts the body into a flight or flight state, which triggers the body to release adrenaline and cortisol, it was hypothesised that Savasana could counteract such stress responses. Assessing and maintaining optimal patient drug titration throughout the surgical phases can be challenging, particularly with certain patient subtypes (geriatric, bariatric, beta-blocked and cardiac patients) as identified by the American Society of Anesthesia (ASA).[9]

In a study involving 20 hypertensive patients treated with psychophysical relaxation exercises followed up monthly for 12 months, statistically significant reductions in blood pressure (BP) and antihypertensive drug requirements were satisfactorily maintained in the treatment group. Repeated BP measurements and increased medical attention did not significantly reduce BP in control patients.[13] In our study, the systolic blood pressure was higher than that of the control group. This may be because reductions in blood pressure were achieved only after two weeks of Savasana practice. Deepa et al. found a significant fall in mean blood pressure after three months of yoga practice ($p < 0.00001$) (SBP: -9.92 mmHg; DBP: -9.83 mmHg) among the mild to moderate essential hypertensives.[14] So a non-pharmacological intervention such as yoga can have a significant effect on the undesirable side-effects of stress.

The Patient State Index™ (PSI) is a quantitative EEG index for assessing the level of consciousness during sedation and general anaesthesia. The PSI values range from 0 (suppression of EEG) to 100 (fully awake and alert), and a PSI in the range of 25–50 indicates an optimal hypnotic state for general anaesthesia.[10] Patient State Index-directed titration of anaesthetic drugs resulted in faster emergence and recovery from anaesthesia, with a modest decrease in the amount.[11] The PSI monitor has the advantage of advanced artefact rejection, such as electrocautery.[12] So PSI is a valuable monitor to assess the depth of anesthesia.

Our study found that the PSI value was well within the desired range up to intubation in the Savasana group, suggesting that yogic recitation significantly impacts the most stressful anaesthetic events. However, the reduction in haemodynamic parameters was not satisfactory in the study group, as it can be mainly attributed to the lack of conditioning that Savasana could achieve only after at least two weeks of practice.

CONCLUSION

Preoperative exposure to Savasana recitation can significantly reduce the incidence of awareness among the study group, thereby providing optimal intubation conditions with minimal effect on haemodynamic parameters. More studies on the effectiveness of Savasana as a non-invasive, non-pharmacological intervention to attenuate the intubation stress response are needed in future.

Limitations

Only one session of savasana practice was provided to the study group. The small sample size was due to the cost of the monitor and its EEG leads.

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