

## EFFECTS OF CHANGING FROM SEVOFLURANE TO DESFLURANE ON THE RECOVERY PROFILE AFTER SEVOFLURANE INDUCTION: A RANDOMIZED CONTROL STUDY

A. Anne Feno<sup>1</sup>, M.A. Mohamed Thaiyub Khan<sup>1</sup>, S. Kammu Kutti<sup>1</sup>

<sup>1</sup>Assistant Professor, Department of Anaesthesiology, Tirunelveli medical college hospital, Tamilnadu, India

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**Corresponding Author:**

**Dr. A. Anne Feno,**

Email: annefenjohnny@gmail.com

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**Abstract**

**Background:** Desflurane has the lowest solubility of currently available volatile anaesthetics and may allow for more rapid emergence and recovery than sevoflurane. The present study aimed to study the effect of changing from Sevoflurane to Desflurane on the recovery profile after Sevoflurane induction. **Materials and Methods:** Seventy patients were enrolled for elective laparoscopic surgeries expected to last less than 2 hours under General Anaesthesia. All enrolled patients were randomly assigned into groups of 35 each as Group S (Sevoflurane) and Group D (Desflurane). Patients were randomized to receive 1-2% sevoflurane for anaesthesia maintenance or 3-6% desflurane. The desflurane group changed the anaesthetic agent from sevoflurane to desflurane within 10 minutes following endotracheal intubation. After surgery, we assessed the following parameters: the times from discontinuing volatile anaesthetics to eye-opening, obeying the command to squeeze the investigator's hand, tracheal extubation, and orientation to the patient's full name. **Result:** The mean age, gender distribution, weight and surgery duration were comparable between the two groups. The distribution of surgery procedures (d lap, Lap Appendix and Lap chole) was comparable in both groups. The parameters like mean eye-opening, time to hand squeeze, time to extubation, time to state the full name, use of drugs/Supplemental O<sub>2</sub> and time to shift out of operation theatre (OT) were found statistically significant ( $p < 0.05$ ) among patients of both groups. **Conclusion:** Changing the anaesthetic agent from sevoflurane to desflurane after sevoflurane induction provides faster emergence and recovery than sevoflurane anaesthesia.

## INTRODUCTION

Successful general anaesthesia mandates the experience to be pleasant with a lack of awareness. Inhalational induction using volatile agents is widely practised as it is convenient and the therapeutic effects are predictable. This has become more popular with the advent of daycare surgeries. The emergence is expected to be rapid and smooth so patients can resume their daily activities as soon as possible.<sup>[1]</sup> The washout speed of inhalational anaesthetics follows an exponential decay with speed inversely parallel to the solubility of anaesthetics in blood. That is, the washout is more rapid for anaesthetics that are less soluble.<sup>[2]</sup>

Because of their convenience and predictable therapeutic effects, volatile anaesthetics such as sevoflurane and desflurane are widely used for general anaesthesia. Maintaining anaesthesia with sevoflurane in day surgery is popular because it has a relatively lower solubility than other volatile

anaesthetics and allows rapid emergence and recovery.<sup>[3]</sup> Additionally, sevoflurane provides smooth volatile induction due to its lack of airway irritation, and it is often used as an induction agent.<sup>[4,5]</sup> Desflurane has the lowest solubility of currently available volatile anaesthetics, which may allow for more rapid emergence and recovery than sevoflurane.<sup>[6]</sup> Additionally, desflurane is associated with more predictable emergence and recovery than sevoflurane.<sup>[7]</sup> Nevertheless, unlike sevoflurane, the use of desflurane for volatile induction is limited because of airway irritation; therefore, when desflurane is employed to maintain anaesthesia, it is initiated after the induction with other anaesthetic agents.<sup>[8]</sup> Although previous studies have reported faster emergence with desflurane than with sevoflurane after induction with intravenous anaesthetics (e.g., propofol and thiopental), few studies have compared emergence and recovery with desflurane vs with sevoflurane after inhalational induction. It is still unknown whether desflurane

provides faster emergence and recovery than sevoflurane, even after volatile induction with sevoflurane.<sup>[9,10]</sup>

This randomized controlled study was designed to elucidate the effects of changing from sevoflurane to desflurane following sevoflurane induction on emergence and recovery (e.g., times to eye-opening, tracheal extubation, and orientation to name, date, and place). We hypothesized that changing the anaesthetic agent from sevoflurane to desflurane during the early phase of anesthesia improves emergence and recovery.

## MATERIALS AND METHODS

In this prospective, double-blinded randomized control study total of 70 patients scheduled for elective laparoscopic surgeries expected to last for less than 2 hours to be performed under general anaesthesia were enrolled. Institutional ethical committee clearance and written consent were obtained.

### Inclusion Criteria

All patients of either sex aged over 18 years with ASA classifications I and II were included.

### Exclusion Criteria

Patients aged < 18 years, with ASA classification more than II, with a history of alcohol or drug abuse, patients who refused to participate in the study and patients with pregnancy were excluded.

Seventy patients were randomly assigned into groups of 35 each as Group S (Sevoflurane) and Group D (Desflurane). No anxiolytic or sedative medications were administered to the patients. Upon arrival at the operating room, standard monitoring devices were placed, including pulse oximetry, automated blood pressure and electrocardiograph and baseline recordings. Baseline recordings of capnography and BIS were also noted.

All patients were pre-oxygenated with 100% O<sub>2</sub> for 3 min. Patients were pre-medicated with Inj Glycopyrrolate 0.2 mg and Inj Fentanyl 100 mcg. Induced with inhalation of O<sub>2</sub> (6 L/min) and sevoflurane 5% using Penlon sigma vaporizer till a BIS value of 40-60 was reached. Inj Atracurium 0.5 mg/kg was administered, and was intubated with an appropriate-size cuffed ETT. In group D, within 10 mins of intubation, an inhalational agent was changed to desflurane using a drager vaporizer. Maintenance

of anaesthesia was with O<sub>2</sub>:N<sub>2</sub>O (33:67), titrated doses of either sevoflurane or desflurane and atracurium aliquots to keep a BIS range of 40-60. 6 mg aliquots of Inj Ephedrine were administered to treat hypotension, defined as a > 30% decrease in systolic blood pressure from the baseline. Bradycardia, defined as heart rate < 60/min, was treated with 0.6 mg of Inj Atropine. Tachycardia, defined as heart rate > 120/min, and hypertension, defined as > 30% increase in systolic pressure from baseline values, were treated with a bolus of 25 mics Inj Fentanyl.

Inj Atracurium was not administered in both groups after letting out the carbo peritoneum. Port sites were infiltrated with local anaesthetics. Controlled ventilation was maintained until the patient's first spontaneous breath was noted, following which the patient's ventilation was manually assisted. The neuromuscular blockade was reversed with Inj Neostigmine 0.04 mg/kg and Inj Glycopyrrolate 0.01 mg/kg. The volatile anaesthetic was discontinued after the reversal. A stopwatch was started from the discontinuation of volatile anaesthetics.

The parameters such as time to eye-opening, time to squeeze hands, time to extubate, time to name, use of drugs/supplemental O<sub>2</sub> and time to shift the patient was noted.

### Statistical Analysis

The collected data was entered in Microsoft Excel (windows 11) and analysed using the statistical package for social sciences (SPSS-19). To find an association between two categorical variables Pearson chi-square test was used. The value of P<0.05 is considered statically significant.

## RESULTS

The mean age, gender distribution, weight and surgery duration were comparable between the two groups. The distribution of surgery procedures (d lap, Lap Appendix and Lap chole) was comparable in both groups.

The parameters like mean eye-opening, time to hand squeeze, time to extubation, time to state the full name, use of drugs/Supplemental O<sub>2</sub> and time to shift out of operation theatre (OT) were found statistically significant (p<0.05) among patients of both groups [Figure 1].

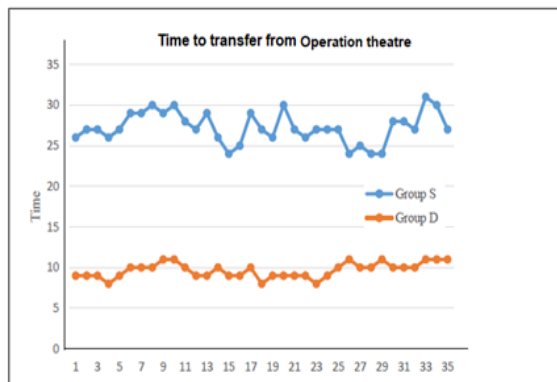
**Table 1: Observation of demographic parameters of patients in both groups**

Parameters	Observation N (%)		P-value
	Group A (N=35)	Group P (N=35)	
Gender			
Male	17	18	0.4
Female	18	17	
Age group (years) (mean± SD)	29.57±6.62	28.40±5.48	0.214
Distribution of surgery procedure			
d lap	16	14	0.25
Lap Appendix	13	16	
Lap chole	6	5	
Duration of surgery (mean± SD)	95.3 ±12.95	97.1±8.23	0.24

Weight (kg) (mean± SD)	58.17 ±4.72	57.94±5.48	0.43
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**Table 2: Observation of all recovery parameters among patients of both group**

Parameters	Observation N (%)		p-value
	Group A (N=35)	Group P (N=35)	
Time to eye-opening (min) (mean ± SD)	6.4 ±2.00	18.7±0.80	<0.01
Time to hand squeezing (min) (mean ± SD)	20.3 ±1.70	7.3±0.70	<0.01
Time to extubation (min) (mean ± SD)	20.3± 1.70	7.3±0.90	<0.01
Time to state the full name (min) (mean ± SD)	26.2± 1.90	8.7±0.90	<0.01
Time to shift out of OT (min) (mean ± SD)	27.2 ±1.90	9.7±0.90	<0.01
Use of drugs/Supplemental O <sub>2</sub>			
Number of patients	11	0	-



**Figure 1: Observation of time taken to transfer patients from OT in patients of both groups**

## DISCUSSION

In our study, the mean age, gender distribution, weight and surgery duration were comparable between the two groups. These findings in the present study follow earlier reported studies.<sup>[11]</sup> The recovery parameters, like mean eye-opening, time to hand squeeze, extubation, and time to state the full name, were found statistically significant ( $p < 0.05$ ) better in Group D patients than in Group S patients.

Previous research on children has indicated that desflurane leads to a faster emergence than sevoflurane after volatile induction with sevoflurane. In our study, we have obtained results that align with these findings, despite differences in the use of nitrous oxide for anaesthesia induction and maintenance in previous studies. However, few studies have directly compared anaesthesia emergence times between desflurane and sevoflurane after volatile induction in adults.<sup>[12]</sup> Additionally, it remains unclear whether switching the anaesthetic agent from sevoflurane to desflurane improves the recovery profile after general anaesthesia. This lack of knowledge can be attributed to the young age of the participants in prior studies, which made it difficult to measure recovery times accurately. Our study observed significantly shorter recovery times, from discontinuing volatile anaesthetics to orientation to the patient's full name, in the desflurane group compared to the sevoflurane group. These findings suggest that transitioning from sevoflurane to desflurane allows for a faster recovery compared to

sevoflurane anaesthesia, even after sevoflurane induction.<sup>[12,13]</sup>

Furthermore, there was a notable difference in the recovery events observed between the two groups. Specifically, the time intervals between tracheal extubation and orientation to the patient's full name were significantly longer in Group S (5.9 minutes) compared to Group D (1.4 minutes). These findings indicate that using sevoflurane for maintenance delays orienting patients to the date and place after tracheal extubation compared to desflurane use. Moreover, the desflurane group exhibited less variability in the time to orient to the state name, suggesting that transitioning from sevoflurane to desflurane offers a more predictable recovery than sevoflurane anaesthesia. These observations made in our study are consistent with prior research findings.<sup>[14]</sup>

Previous research has made attempts to harness the benefits of different volatile anaesthetics.<sup>[15]</sup> Some studies have explored the effects of transitioning from isoflurane to desflurane towards the end of anaesthesia. Gong et al. have specifically reported positive outcomes in terms of improved recovery from general anaesthesia when switching from enflurane to desflurane.<sup>[16]</sup> However, studies are scarce investigating the advantages of transitioning from sevoflurane to desflurane. In our present study, none of the patients experienced severe adverse events during volatile induction, and we observed that changing from sevoflurane to desflurane facilitated rapid emergence and recovery.

Use of drugs/Supplemental O<sub>2</sub> was required by 11 patients in Group S. In contrast, no patients required it in Group D. Moreover, the time to shift patients from operation theatre (OT) is much shorter with desflurane than with sevoflurane, as patients in Group S who were given medications to alleviate the emergence phenomenon had to be observed in the OT for few minutes. Hence use of this technique can achieve both smooth induction and rapid recovery without pain on intravenous catheter insertion or injection of intravenous anaesthetics such as propofol.<sup>[17]</sup>

## CONCLUSION

Changing the anaesthetic agent from sevoflurane to desflurane after volatile induction with sevoflurane

provides faster emergence and recovery than sevoflurane anaesthesia. This technique favours smooth induction and rapid recovery with high patient satisfaction.

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