

# A Comparative Study of Recovery and Postoperative Cognitive Functions after General Anesthesia with Sevoflurane or Desflurane Based Techniques in Elderly Patients

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## Abstract

**Context:** It is clear that the number of elderly is going to rise in coming days. Hence, number of elderly requiring surgery and anesthesia is also on increase. At the same time, there are newer developments in the field of anesthesia. Hence, operation theatre staff and doctors should know which agent is better when given the choice

**Aim:** To compare recovery and postoperative cognitive functions after general anesthesia with sevoflurane or desflurane based technique in elderly patients.

**Settings and Design:** Prospective Randomized Controlled Comparative Interventional study was conducted at KIMS Hospital, Kondapur, Hyderabad.

**Methods:** 120 patients undergoing surgeries under general anesthesia were included. They were randomly assigned in two groups of 60 each; with one group receiving Sevoflurane and the other desflurane. Two groups were compared for different parameters

**Statistical Analysis:** Chi Square Test was applied for categorical data and t test for the continuous data.

**Results:** Both the groups were comparable in terms of age and sex. Mean BMI was significantly higher in desflurane group compared to sevoflurane group ( $p < 0.05$ ). Mean duration was significantly higher in desflurane group cases. The recovery indices were significantly better in desflurane group cases ( $p < 0.05$ ). MMSE scores were not significantly different in two groups ( $p > 0.05$ ). Incidence of POCD in two groups was comparable ( $p > 0.05$ ).

**Conclusion:** Both the drugs i.e. desflurane and sevoflurane are equally effective among elderly cases undergoing surgery under general anesthesia in preventing POCD.

**Keywords:** Sevoflurane; Desflurane; Efficacy; Anesthesia; Surgery.

**Key messages:** Desflurane and sevoflurane can be used in elderly patients undergoing surgery under general anesthesia.

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## Introduction

Globally medical provision is vastly contributed by the elderly above the age of 65 years. This is due to increasing life expectancy and economic development. Age related degenerative changes are common. They also occur in cardiovascular and respiratory system as well.<sup>1</sup> Hence elderly are at more risk of developing complications of anesthesia compared to their younger counterparts. Postoperative cognitive dysfunction (POCD) incidence was 25.8% at the end of one week and 9.9% at the end of three months after surgery.<sup>2</sup> Following this, they are at high risk of developing dementia over 3-7 years of surgery.<sup>3</sup>

We do not know exactly how POCD occurs. The common risk factors are increasing age, known cases of vascular disease, cardiac disease and cerebral disease, complications during surgery and abuse of alcohol.<sup>4</sup> Apart from this, it has been suspected that due to residual effects of anesthetic drugs over central nervous system, they can also contribute to POCD. Hence it has been recommended that incidence of POCD can be reduced with rapid recovery from anesthesia.<sup>5</sup>

Compared to traditional volatile anesthetics, Desflurane and sevoflurane, have properties of "low blood gas partition coefficients". They are known for rapid recovery from anesthesia and hence are drugs of choice in elderly.<sup>6</sup> One study has shown that desflurane help in rapid recovery from anesthesia. The patients given this drug become oriented rapidly compared to sevoflurane.<sup>7</sup> However in another study, it was seen that the recovery time was similar for both the drugs.<sup>8</sup> The incidence of POCD was comparable in two groups receiving these drugs.<sup>7</sup> It was observed by other author that the cognitive function was better after surgery in those who received desflurane compared to sevoflurane in elderly.<sup>9</sup>

It is clear that the number of elderly is going to rise in coming days. Hence, number of elderly requiring surgery and anesthesia is also on increase. At the same time, there are newer developments in the field of anesthesia. Hence, operation theatre staff and doctors should know which agent is better when given the choice. With this background, present study was carried out to compare recovery and postoperative cognitive functions after general anesthesia with sevoflurane or desflurane based technique in elderly patients.

## Materials and Methods

After getting approval from the hospital ethics

committee and prior informed consent from the patients this study was conducted.

This is a randomized study of 120 consecutive patients undergoing elective surgical procedure under general anesthesia in KIMS Hospital, Kondapur, Hyderabad, satisfying the inclusion and exclusion criteria. The study period will be from September 2019 to August 2021.

### Inclusion criteria

- Elderly of age 65 years and above of either gender.
- having ASA grade I, II.
- Patients undergoing surgeries under general anesthesia lasting from 45 minutes up to 3 hours.

### Exclusion criteria

- Patients who underwent general anesthesia in the past seven days.
- Patients with h/o neuropsychiatric disorders.
- Not able to read and write.
- Patients with impaired hearing.
- Having ASA grade III, IV.

Elderly of either gender above the age of 65 years were included. During the study period, it was possible to include 120 eligible cases as per the inclusion and exclusion criteria laid down for the present study. They were randomly assigned in two groups of 60 each. One group received Sevoflurane and the other group received desflurane.

Mini-Mental State Examination (MMSE) test was carried out on all cases in the pre-operative area. This test is used to assess the cognitive impairment. A score of 23 or less indicates that there is cognitive impairment. We conducted this test on all cases before and after surgery (at 1, 3, 6, 24 hours after the end of anesthesia). If there is a drop of two or more points, we took it as cognitive impairment.

Upon arrival of the patient, depending upon the fluid deficiency, plasmalyte-A was started. The patient was connected with the monitors like ECG, NIBP and pulse oximeter. For induction of anesthesia, fentanyl and propofol were given intravenously in the dose of 1-2 mcg/kg and 1-2 mg/kg respectively. Tracheal intubation will be facilitated with vecuronium 0.1mg/kg or atracurium 0.5mg/kg. Later, one group received desflurane in the dose of 6% and the other group patients received sevoflurane in the dose of 2% using tec6 vaporizer. These agents were used to maintain the anesthesia. All cases were monitored

at regular intervals. At the end of surgery, residual neuromuscular blockade will be reversed using glycopyrrolate, 0.01 mg/kg IV, and neostigmine, 0.05 mg/kg IV, Sevoflurane or Desflurane will be discontinued at the end of surgery. The times from discontinuing Inhalation agents to eye opening, tracheal extubation, obeying commands, as well as the times to orientation to name and place will be assessed at 30-60 sec intervals. All other standard precautions and procedures were followed.

### Statistical analysis

The data was expressed as mean and standard deviation. The homogeneity in two groups of mean and standard deviation were analyzed using SPSS 23 version. Variables were compared using student t test for parametric data.  $p < 0.05$  was considered statistically significant, value  $< 0.01$  considered highly significant, and  $p > 0.05$  was considered insignificant.

### Results

Both the groups were comparable in terms of age and sex ( $p > 0.05$ ). The mean body mass index (BMI) was significantly higher in desflurane group compared to sevoflurane group ( $p < 0.05$ ). (Table 1).

**Table 1:** Comparison of baseline characteristics in two groups.

Characteristics	Sevoflurane group	Desflurane	t/chi square value	p
Mean age (years)	69.1±3.59	68.7±3.69	t=0.654	0.515
Sex			X <sup>2</sup> = 4.8	0.243
Male	39 (65%)	33 (55%)		
Female	21 (35%)	27 (45%)	-	-
Mean BMI (kg/m <sup>2</sup> )	24.8±2.55	28.4±3.93	t=-6.301	0.001

The mean duration was significantly higher in desflurane group cases. The recovery indices were significantly better in desflurane group cases

**Table 2:** Comparison of different characteristics in two group.

Characteristics	Sevoflurane group	Desflurane	t value	p	
Mean duration (min)	100.83±29.59	114.8±33.07	t=-2.771	0.007	
Recovery indices	Eye opening	7.18±0.55	4.8±0.59	t= 22.199	0.000
	Extubation	9.82±0.6	6.7±0.59	t= 28.43	0.000
	Commands	11.8±0.54	8.3±0.52	t= 38.065	0.000
	Orientation	13.03±0.41	9.8±0.62	t= 37.14	0.000
Mini Mental State Examination (MMSE)	Pre-operative	28.48±1.06	28.51±1.12	t= -0.150	0.881
	1 <sup>st</sup> hour	26.56±1.68	26.68±1.65	t= 0.343	0.733
	3 <sup>rd</sup> hour	27.26±1.52	27.31±1.37	t= 0.168	0.867
	6 <sup>th</sup> hour	28.36±1.22	28.33±1.18	t= -0.137	0.892
	24 <sup>th</sup> hour	28.50±1.14	28.45±1.11	t= -0.221	0.826

( $p < 0.05$ ). The MMSE scores were not significantly different in two groups ( $p > 0.05$ ). (Table 2).

The incidence of POCD in two groups was comparable i.e. it was not significantly different ( $p > 0.05$ ). (Table 3).

**Table 3:** Comparison of Post-Operative Cognitive Dysfunction (POCD) in two groups.

POCD	Sevoflurane group	Desflurane	chi square value	p
At 1 hour	35 (58.33%)	32 (53.33%)	2.98	0.225
At 3 hours	23 (38.33%)	27 (45%)	-	-
At 6 hours	2 (3.33%)	1 (1.7%)	-	-

There was no difference in two groups in terms of mean propofol and fentanyl requirement ( $p > 0.05$ ). (Table 4).

**Table 4:** Comparison of mean propofol and fentanyl Requirements in the two group.

Variable	Sevoflurane group	Desflurane	t value	p
Propofol (mg)	133.67±8.23	132.8±10.43	0.533	0.596
Fentanyl (mg)	109±11.89	109±11.89	0.00	1.00

**Table 5:** Comparison of type of surgeries between the two Groups.

Type of surgery	Sevoflurane group	Desflurane	chi square value	p
Gastro-surgery	28 (46.7%)	22 (36.7%)	1.266	0.737
Uro-surgery	3 (5%)	3 (5%)	-	-
Ortho and spine	20 (33.33%)	25 (41.7%)	-	-
Obstetrics surgery	3 (5%)	3 (5%)	-	-
Total	60 (100%)	60 (100%)	-	-

The number of cases undergoing different types of surgeries in two groups was not different ( $p > 0.05$ ). (Table 5).

## Discussion

In our study, the age wise distribution of 60 patients of both groups signified that the mean age of study subjects in sevoflurane group was  $69.1 \pm 3.59$  years and  $68.7 \pm 3.69$  years in desflurane group. The findings of our study were found consistent with the findings of previous studies.

Postoperative cognitive dysfunction (POCD) was found to be present in 25.8% of elderly patients at 1 week after surgery and 9.9% of elderly patients at 3 months after surgery.<sup>2</sup> In addition, elderly patients who developed POCD were twice as likely to develop dementia in the following 3–7 years after anaesthesia and surgery compared with those unaffected by POCD.<sup>3</sup>

We do not know exactly how POCD occurs. The common risk factors are increasing age, known cases of vascular disease, cardiac disease and cerebral disease, complications during surgery and abuse of alcohol.<sup>4</sup> Apart from this, it has been suspected that due to residual effects of anesthetic drugs over central nervous system, they can also contribute to POCD. Hence it has been recommended that incidence of POCD can be reduced with rapid recovery from anesthesia.<sup>5</sup>

Both the groups were comparable in terms of age and sex ( $p > 0.05$ ). Other authors noted similar results as well.<sup>10,11</sup> The mean body mass index (BMI) was significantly higher in desflurane group compared to sevoflurane group ( $p < 0.05$ ).

In our study significant difference between both groups for durations of anesthesia was reported ( $p = 0.007$ ). Reportedly, in some individuals, cognitive recovery is fast (within a matter of hours), whereas, in others, brain function may be disturbed for a much longer time. Others reported similar findings also.<sup>12</sup>

In the present study POCD were compared between the treatment groups. It was reported that patients experienced cognitive dysfunction at the end of 1hr, 3hr, 6hr, 24 hr POCD was 58.33%, 38.33%, 3.33%, 0% patients respectively in sevoflurane group. It was also reported that patients experienced cognitive dysfunction at the end of 1hr, 3hr, 6hr, 24 hr POCD was 53.33%, 45%, 1.7%, 0% respectively in desflurane group.

In our study eye opening was reported  $7.18 \pm 0.55$  and  $4.8 \pm 0.59$  in sevoflurane and desflurane group. Extubation was reported in  $9.82 \pm 0.60$  and  $6.7 \pm 0.59$  in sevoflurane and desflurane group. Commands was reported in  $11.80 \pm 0.54$  and  $8.3 \pm 0.53$  in sevoflurane and desflurane group. Orientation was reported in  $13.03 \pm 0.41$  and  $9.8 \pm 0.62$  in sevoflurane and

desflurane group respectively. In a reference study Pensado Castiñeiras<sup>13</sup> reported early post-operative recovery with desflurane with mean times to eye opening 7.6, 7.8 min, time until extubation 7.8, 8.3min. For desflurane and sevoflurane. Heavner et al<sup>14</sup> also reported similar findings.

In the present study, the incidence of POCD in two groups was comparable i.e. it was not significantly different ( $p > 0.05$ ). In previous studies Chen et al., (2001)<sup>15</sup> and RA Rortgen et al., (2010)<sup>16</sup> have also not found any significant change in the post-operative cognitive functions in desflurane and sevoflurane groups. Ravi Jindal et al<sup>17</sup> found that the cases in the desflurane group opened eyes earlier than those in the sevoflurane group. One study found that POCD was reversible.<sup>18</sup> Deepak TS et al<sup>19</sup> observed that all cases who received desflurane and 97% who received sevoflurane were free of POCD six hours after surgery. Baliarsing et al 20 found that anesthesia recovery was quicker due to desflurane but the cognitive recovery was comparable in two groups.

## Conclusion

Desflurane is associated with quicker recovery from anesthesia compared with sevoflurane. However, the cognitive recovery is comparable in two groups. Similarly, MMSE also remains comparable in two groups. Thus, we conclude that both the drugs i.e. desflurane and sevoflurane are equally effective among elderly cases undergoing surgery under general anesthesia in preventing POCD.

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