

# A Comparison of Desflurane and Sevoflurane in the Recovery of Cognitive Function after General Anesthesia in Elderly Patients.

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## ABSTRACT

**Background:** The postoperative cognitive dysfunction (POCD) or psychomotor function disorder is known to be associated with the anesthetic agents, as well as the physiological changes resulting from the anesthesia. The known risk factors are old age, preexisting cerebral cardiac or vascular disease, alcohol abuse, intra and post-operative complications. **Methods:** 50 patients above 65 years of age falling into ASA Grade 1, 2 or 3 were categorized into 2 groups, one (Group A) wherein Sevoflurane was given as the anesthetic agent and the other (Group B) where Desflurane was administered. All had undergone physical and regular blood examination. MMSE score was taken for all patients for cognitive recognition before surgery and 1, 3, and 6 hours after surgery. **Results:** Of the 50 patients, the MMSE score was above 27 for all before surgery, while, post-surgery it was below 27 after 1 hour in 100% of the cases. After 3 hours, in the group A, the mean MMSE was above 27 while it was still below 27 in Group B while it was above 27 in both the Groups after 6 hours post-surgery. There was only 1 cases of POCD after 6 hours in Group A and none in Group B. The recovery time was faster in group B as compared to Group A. **Conclusion:** Desflurane was marginally a better anesthetic agent in terms or recovery to Sevoflurane and Sevoflurane was slightly better than the former when it came to cognitive recognition Therefore, we conclude that both the drugs are equally good anesthetic agents.

**Keywords:** Cognition, Desflurane, Sevoflurane, Geriatric patients, MMSE, POCD.

## INTRODUCTION

Geriatric patients are those who are above 65 years of age and account for a large proportion of population. Due to the development in medical treatment, the life expectancy of the people is continuously on the rise, resulting in the rise of elderly population.<sup>[1]</sup> But, age related diseases, like age-related degeneration in respiratory and cardiovascular function and other associated systemic diseases are still prominent. Therefore, such patients are at risk of having complications due to anesthesia.<sup>[2]</sup>

The postoperative psychomotor disorder is defined as the postoperative cognitive dysfunction (POCD).<sup>[3]</sup> The psychomotor function disorder may be associated with the anesthetic agents, as well as the physiological changes resulting from the anesthesia.<sup>[4,5]</sup> This POCD was seen in 25.8% of the elderly within 1 week of surgery and after 3 months of surgery in 99% of the cases. These geriatric patients are twice as likely to develop dementia in 3-7 years of developing POCD after anesthesia in comparison to those who have not developed POCD.<sup>[6]</sup>

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The cause of POCD is unclear, but the known risk factors are old age, preexisting cerebral cardiac or vascular disease, alcohol abuse, intra and post-operative complications. Drugs used for anesthesia can also effect the postoperative cognition as their residual effects can alter the central nervous system.<sup>[7-9]</sup>

The knowledge of the factors that cause the cognitive deterioration and analysis of the methods of evaluation and treatment will help if effective measures are taken to reduce the frequency and severity of this condition.<sup>[10]</sup>

One of the major reasons for speedy recovery from anesthesia is the choice of anesthetic technique used. An ideal general anesthetic, for the ambulatory patients, should provide smooth and rapid induction, optimal operating conditions, and rapid recovery with minimal side effects like nausea, vomiting, bleeding and postoperative pain.<sup>[11]</sup>

Sevoflurane, a halogenated ether is a highly volatile anesthetic which has induction due to low blood: gas partition (blood: gas partition coefficient of 0.65 and fat: blood solubility 48 at 37°C). Desflurane is also halogenated ether, with a low solubility in blood and body tissues (blood: gas partition coefficient of 0.42 and fat: blood solubility 27 at 37°C) leads to rapid induction and recovery. Both of them have a shorter emergence times compared to the other anesthetics.<sup>[11-13]</sup>

The aim of the present study was to compare postoperative cognitive function and the time to

specific recovery events in elderly patients anaesthetized with sevoflurane or desflurane.

**MATERIALS AND METHODS**

This study was conducted on 50 geriatric patients falling into ASA Group 1, 2 or 3, admitted for elective surgery at IMSR Medical College for the period of one year. The duration of the surgeries were from 30 minutes to 4 hours. The study was conducted after obtaining the ethical approval from authorities and informed consent from the patients. Patients with neuropsychiatric disorders, alcohol consumption, and other significant cardiovascular, neurological, psychiatric and other metabolic disorders were excluded from the study.

The patients were randomized into 2 groups– Group A consisted of 25 patients who were given Sevoflurane and Group B consisting of 25 patients who were given Desflurane. Mini Mental State Score was taken preoperatively and 1, 3, 6 and 24 hours post-surgery to check the cognitive status of the patient. A score of above 27 is taken as normal cognition.

**Table 1:** Gender wise distribution of patients

Gender	Group A n = 25	Group B n = 25
Males	14 (56%)	14 (56%)
Females	11 (44%)	11 (44%)

All patients were subjected to a pre anesthetic exam which consisted of physical examination, radiological exam where necessary, blood tests like complete blood picture, hemoglobin, random blood sugar, serum creatinine, serum urea and uric acid levels, and complete urine examination. All of them were kept on fasting for a minimum of 6 hours before surgery. All these patients received fentanyl 1.0 2 mcg/kg and propofol, 1.5-2.0 mg/kg, before receiving desflurane

2%-5% or sevoflurane 0.5%-1.75% with nitrous oxide 65% in oxygen for anesthesia. Muscular relaxation was maintained using intermittent doses of vecuronium bromide at proper intervals.

**Table 2:** Operating and anesthesia time in both groups

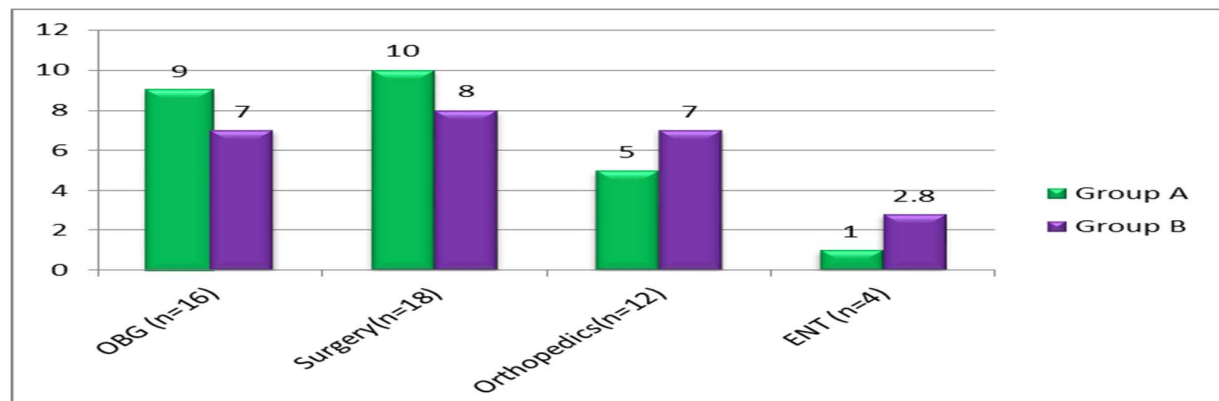
Groups	Mean Operating time (in mins)	Mean Anaesthesia time (in mins)
GroupA (Sevoflurane)	97.8	103.6
GroupB (Desflurane)	102.4	110.9

Noninvasive blood pressure, Heart rate and oxygen saturation were recorded before anesthesia was given for all patients. They were monitored using SpO<sub>2</sub>, non-invasive blood pressure (NIBP), electrocardiogram (ECG), HR and end-tidal carbon dioxide (EtCO<sub>2</sub>) every 2 minutes after anesthesia was given for 15 minutes and then every 15 minutes thereafter till the end of the surgery. The temperature was maintained at 36<sup>o</sup>C.

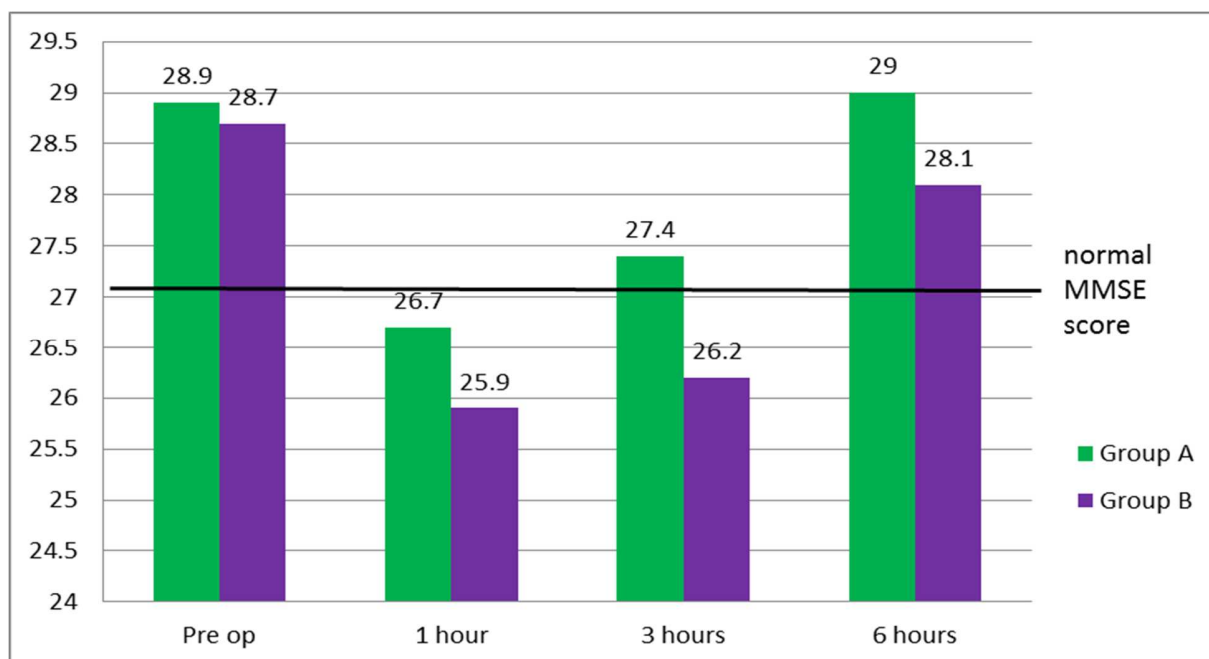
Before the start of closure of the surgery, Sevoflurane and Desflurane were discontinued. Antiemetic prophylaxis consisted of a combination of ondansetron (4mg), dexamethasone (4mg), and metoclopramide (10 mg) at the end of surgery. During recovery, the time to open the eyes, follow commands, extubation, orientation, first oral intake, sitting, standing and discharge from the recovery room was noted. Complications like vomiting, nausea, etc were also noted.

**RESULTS**

50 patients were involved in this controlled trial where in 28 were males and 22 were females. Of the 25 in Group A (Patients given sevoflurane) and Group B (Patients given desflurane), 14 were males while 11 were females each [Table 1]



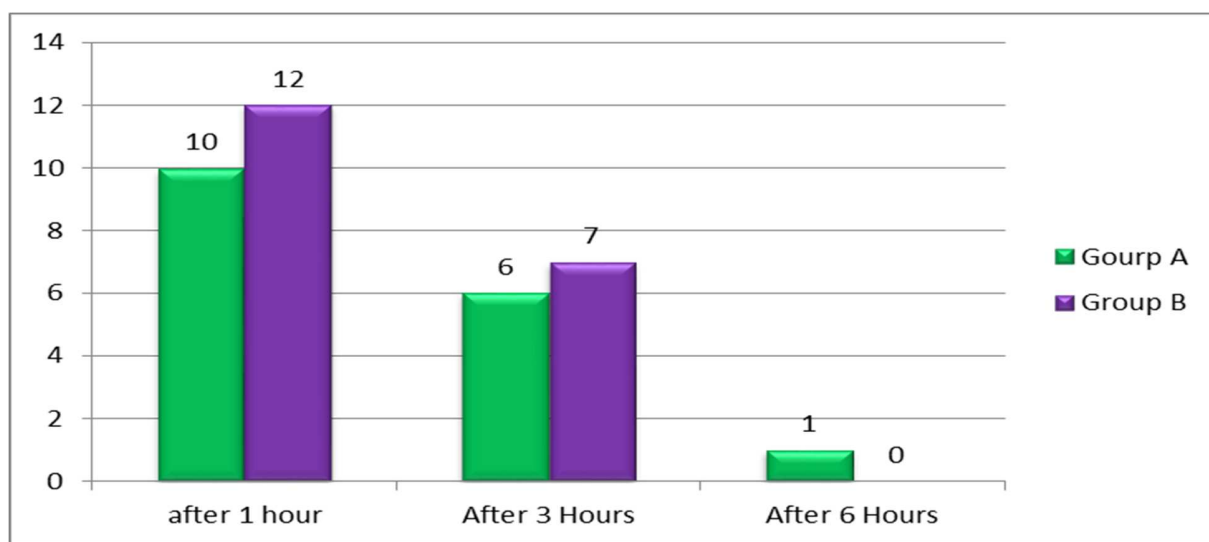
**Figure 1:** Types of surgeries in the two groups



**Figure 2:** Mean MMSE for both groups pre and post operatively.

**Table 3:** Mean time taken for recovery of patients.

Characters	Mean (in mins)		Min Time (in mins)		Max Time (in mins)	
	Group A	Group B	Group A	Group B	Group A	Group B
Eye opening	7.2	4.9	5	4	10	7
Extubation	9.1	6.9	7	5	12	10
Response to Commands	11.9	8.2	9	7	15	11
Orientation	12.9	9.42	11	8	15	12



**Figure 3:** Post-operative cognitive dysfunction

The elective surgeries were from the Gynecology, Orthopedics, surgery and ENT [Figure 1].

The operating time for both groups were similar with the mean time being around 97-102 minutes and the anesthesia time being 103 – 111 minutes [Table 2].

The Mini mental score before the surgery showed all patients to be well within the cognitive levels. Although the scores were just below 27 within 1 hour of post-surgery, they were in the cognitive limits by 3 hours of surgery [Figure 2].

The recovery was seen marginally faster in case of Group B where Desflurane than in Group A where Sevoflurane was given. The mean time for the eye opening in group A was 7.2 minutes while in group B was 4.9 minutes. The minimum time taken was 5 minutes and maximum was 10 minutes [Table 3].

The post-operative cognitive dysfunction on an average was seen in 10 patients after 1 hour in Group A while in 12 patients it was seen in Group B. Only 1 patient in Group A showed POCD after 6 hour [Figure 3].

## DISCUSSION

Post-operative cognitive dysfunction is characterized by impairment of memory and cognitive function, reduced ability to concentrate and deterioration in emotional or social behavior.<sup>[14,15]</sup> The main types of cognitive deterioration post-surgery are delirium, short-term cognitive disturbance and true POCD which may last for weeks, months or even longer.<sup>[14]</sup> Early POCD is seen more often in the elderly.

In our study, we compared recovery time in elderly patients undergoing general anesthesia with sevoflurane or desflurane and compared the incidence and duration of cognitive impairment. The demographic details like age and other tests like physical examination and blood tests were comparable in both the groups.

The operating time and the anesthesia time was also comparable in both the groups. The time taken in our study for the patient to open the eyes after the end of anesthesia was faster in case of patients given Desflurane rather than Sevoflurane. The results were noted for extubation, response to commands and orientation. The maximum time taken by group B for the same responses was also lesser than that of Group A. Similar results were observed in other studies.<sup>[16-20]</sup> This faster recovery could be because of low lipid solubility of desflurane.<sup>[17]</sup> The speed of tissue wash-in and wash-out is determined by tissue/blood partition coefficient, and the blood/brain partition coefficients of desflurane and sevoflurane are  $1.29 \pm 0.05$  and  $1.7 \pm 0.09$ , respectively. Normally the opening of the eyes in as indicator to the recovery of the patient from anesthesia.<sup>[19]</sup>

Though we found the time of recovery to be shorter, in other studies, no significant difference was noted. In a study by Deepak et al, no difference was found

in the recovery time between the two groups. Chen et al<sup>[19]</sup>, and Rotgen et al<sup>[21]</sup> also found no significant difference in other similar studies.

Several factors have been shown to contribute to POCD, including increasing age, alcohol abuse, hypoxia, hypotension and type of surgery.<sup>[22]</sup>

In the present study, there was no difference of the MMSE Score in among the patients administered with Sevoflurane and with Desflurane. There also was 1 case of POCD after 6 hours of surgery among the patients in our study. TS Deepak et al<sup>[20]</sup>, Chen et al<sup>[19]</sup> in similar studies concluded that there was no difference of cognitive levels of these two drugs on patients. This shows that both these drugs can be used equally for anesthesia on patients even the elderly ones.

There were a few limitations to this study. The study population was small and the patients were followed up to discharge alone and could not be followed up to 6 months to detect the progression onto dementia, which is one of the consequences of POCD.

## CONCLUSION

We conclude that among the two drugs, desflurane seems to be associated with faster recovery from general anesthesia compared to sevoflurane. Though desflurane showed slightly lesser cognitive score as compared to sevoflurane, it was not significant. Hence, both Desflurane and Sevoflurane can be equally used as general anesthetic agents.

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