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Research Article

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 catagrzed 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 I hour in 100% of the cases. After 3 hours, in 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.
Conclusions: 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: Desflurane, Sevoflurane, Cognition, MMSE, Geriatric patients, 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.[1] 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.[2]

The postoperative psychomotor disorder is defined as the postoperative cognitive dysfunction (POCD).[3] The psychomotor function disorder may be associated with the anesthetic agents, as well as the physiological changes resulting from the anesthesia.[4,5] 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.[6]

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 ass their residual effects can alter the central nervous system.[7-9]

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.[10]

One of the major reasons for speedy recovery from anaesthesia is the choice of anesthetic technique used. An ideal general anaesthetic, 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.[11]

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 compard to the other anesthetics.[11-13]

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.

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, 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.

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 1.02 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.

Non-invasive blood pressure, heart rate and oxygen saturation were recorded before anaesthesia was given for all patients. They were monitored using SpO_2, Non-Invasive Blood Pressure (NIBP), electrocardiogram (ECG), HR and End-tidal Carbon Dioxide ($EtCO_2$) 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°C.

Before the start of closure of the surgery, sevoflurane and desflurane were discontinued. Antiemetic prophylaxis consisted of a combination of ondansetron (4 mg), dexamethasone (4 mg), 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).

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%)

The elective surgeries were from the gynecology, orthopedics, surgery and ENT (Figure 1).

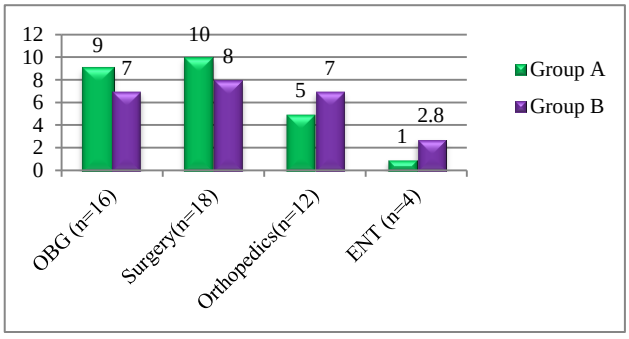

Figure 1: Types of surgeries in the two groups.

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).

Table 2: Operating and anesthesia time in both groups.

	Mean operating time (minutes)	Mean anaesthesia time (minutes)
Group A (Sevoflurane)	97.8	103.6
Group B (Desflurane)	102.4	110.9

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 in sevuflurane was given 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).

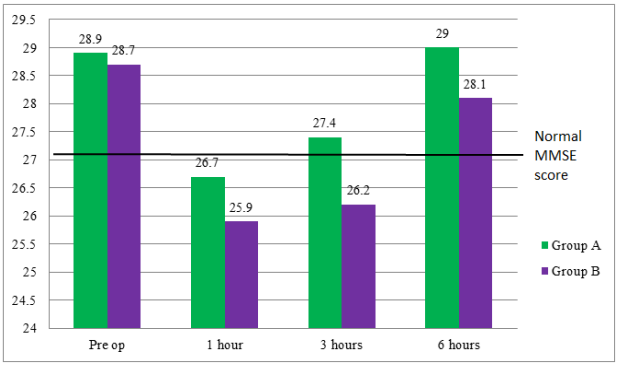

Figure 2: Mean MMSE for both groups pre and post operatively.

Table 3: Mean time taken for recovery of patients.

	Mean (minutes)		Min time (minutes)		Max time (minutes)	
	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

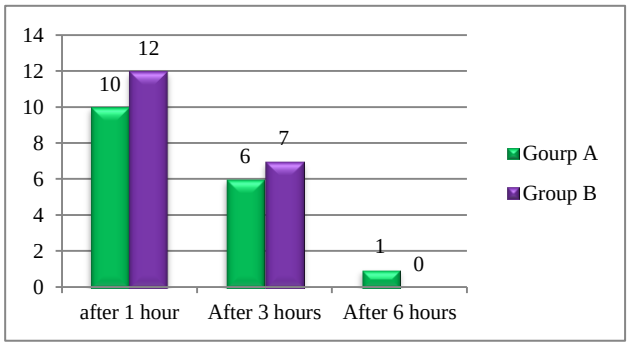

Figure 3: The post-operative cognitive dysfunction in patients.

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.[14,15] 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.[14] 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 were 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 by Heavner et al.[16] Chen et al.[18] and by T. Deepak et al.[20] This faster

recovery could be because of low lipid solubility of desflurane.[17] 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 ± 0.05 and 1.7 ± 0.09, respectively.[17] Normally the opening of the eyes in as indicator to the recovery of the patient from anesthesia.[19]

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 tie between the two groups. Chen et al.[19] and Rotgen et al.[21] 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.[22]

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. Deepak TS et al.,[20] Chen et al.[19] 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 upto discharge alone and could not be followed upto 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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Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Monk TG, Price CC. Postoperative cognitive disorders. Curr Opin Crit Care. 2011;17:376-81.
2. Moller JT, Cluitmans P, Rasmussen LS, Houx P, Rasmussen H, Canet J, et al. Long-term postoperative cognitive dysfunction in the elderly ISPOCD1 study. ISPOCD investigators. International Study of Post-Operative Cognitive Dysfunction. Lancet. 1998;351:857-61.
3. Öğün CÖ, Topal A, Duman A, Erol A, Ökesli S. Remifentanil-sevofluran-azotprotoksit anestezisinde propofol ve tiyopenton'un orta ve ileri Yaştaki Kadınlarda derlenmeye ve Erken Kognitif Fonksiyonlara Etkisi. J Turk Anaesth Int Care. 2002;30:209-17.
4. Hoke JF, Cunningham F, James MK, Muir KT, Hoffman WE. Comparative pharmacokinetics and pharmacodynamics of remifentanil, its principle metabolite (GR 90291) and alfentanil in dogs. J Pharmacol Exp Ther. 1997;281(1):226-32.
5. Ucuzal M, Akyolcu N. Postoperative cognitive changes in elderly. Turk J Geriatr. 2008;11(3):119-27.
6. Chen PL, Yang CW, Tseng YK, Sun WZ, Wang JL, Wang SJ, et al. Risk of dementia after anaesthesia and surgery. Br J Psychiatry. 2014;204:188-93.
7. Wang W, Wang Y, Wu H, Lei L, Xu S, Shen X, et al. Postoperative cognitive dysfunction: current developments in mechanism and prevention. Med Sci Monit. 2014;20:1908-12.
8. Davison LA, Steinhelber JC, Eger EI 2nd, Stevens WC. Psychological effects of halothane and isoflurane anesthesia. Anesthesiology. 1975;43:313-24.
9. Drummond GB. The assessment of postoperative mental function. Br J Anaesth. 1975;47:130-42.
10. Sebel PS, Hoke JF, Westmoreland C, Hug CC Jr, Muir KT, Szlam F. Histamine concentrations and hemodynamic responses after remifentanil. Anaest Analg. 1995;80(5):990-3.
11. Jindal R, Kumra VP, Narani KK, Sood J. Comparison of maintenance and emergence characteristics after desflurane or sevoflurane in outpatient anaesthesia. Indian J Anaesth. 2011;55:36-42.
12. Eberts TJ, Schmid PG. Inhaled anesthetics. In: Barash PG, Cullen BF, Stoelting RK, Cahalan MK, Stock MC, eds. Clinical Anesthesia. 6th ed. Philadelphia: Lippincott Williams and Wilkins; 2009: 413-443.
13. Morgan GE Jr, Mikhail MS, Murray MJ. Inhalational anesthetics. In: Morgan GE Jr, Mikhail MS, Murray MJ, eds. Clinical Anesthesiology. 4th ed. New York: McGraw-Hill; 2006: 155-178.
14. Rasmussen L, Stygall J, Stanton PN. Cognitive dysfunction and other long-term complications of surgery and anesthesia. In: Rasmussen L, Stygall J, Stanton PN, eds. Miller's Anesthesia. 7th ed. Philadelphia: Churchill Livingstone Elsevier; 2010: 2805-2819.
15. Savita Babbar, Upasana Goswami, Saurabh Tiwari. Comparative evaluation of the effects of propofol and sevoflurane on cognitive function and memory in patients undergoing laparoscopic cholecystectomy: a randomised prospective study. Indian J Anaesth. 2015 Mar;59(3):150-5.
16. Heavner JE, Kaye AD, Lin BK, King T. Recovery of elderly patients from two or more hours of

desflurane or sevoflurane anaesthesia. Br J Anaesth. 2003;91(4):502-6.
17. Yasuda N, Targ AG, Eger EI 2nd. Solubility of the I-653, sevoflurane, isoflurane, and halothane in human tissues. Anesth Analg. 1989;69:370-3.
18. Gang Chen, Youfa Zhou, Qingyu Shi, Haiyan Zhou. Comparison of early recovery and cognitive function after desflurane and sevoflurane anaesthesia in elderly patients: a meta-analysis of randomized controlled trials. J Int Med Res. 2015 Oct;43(5):619-28.
19. Chen X, Zhao M, White PF, Li S, Tang J, Wender RH, et al. The recovery of cognitive function after general anesthesia in elderly patients: a comparison of desflurane and sevoflurane. Anesth Analg. 2001;93:1489-94.

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