

Comparative Study of Recovery and Cognitive Dysfunction Following Desflurane versus Sevoflurane in General Anesthesia in Elderly Patient Undergoing Major Surgery

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Abstract

Geriatric patients (age 65 years and above) are more prone to POCD who undergo general anesthesia. Also the geriatric patients with co morbidities and substance abuse have higher chances for POCD.

Objective: To compare Post-operative cognitive status and recovery (time specific) in geriatric patients undergoing general anesthesia with sevoflurane or desflurane, by MMSE score. Also to compare other side effects and recovery.

Materials and Methods: This is prospective, randomized, interventional, single blind study. A study of 70 patients of either sex, ASA-I/II/III in the age group of above 65 years who were operated under general anesthesia and randomly allocated in two equal groups. Group S consisted of 35 patients who were given sevoflurane. Group D consisted of 35 patients who were given desflurane. MMSE score was taken pre-operatively and patients with score more than 27 were selected for this study.

Results: Statistically significant immediate recovery from general anesthesia was noted in group D compared to group S. But difference in post-operative MMSE score at 1 hour, 3 hours and 6 hours between group S and group D was statistically insignificant.

Conclusion: Patients given General Anesthesia with Desflurane showed early recovery signs, i.e. eye opening, following of verbal commands and extubation compared to patients given sevoflurane which is statistically proven. But MMSE score was lesser in desflurane than sevoflurane, which was insignificant.

Keywords: MMSE-Mini mental state examination; POCD- Post-operative Cognitive dysfunction.

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Introduction

Age more than 65 years is called geriatric population. This group is rapidly growing part of population in both the developing and developed countries. With advanced healthcare facilities, life expectancy of the population is increasing but because of the lifestyle and food habits the probability of this group for undergoing surgery is also increasing.

With the aging, there occurs progressive loss of functional reserve of all organs. In brain, there is decrease in gray matter volume, neuronal shrinkage leading to reduction in efficient functioning of the brain. 40% of population with age more than 60 years show decline in memory.¹² Decrease in brain reserve is manifested by decrease in Activity in Daily Living and also leads to increase in sensitivity for the anaesthetic drugs, increase in risk of post-operative delirium and POCD 7-8. Short term changes in cognitive functions are noted after GA during first few days after surgery.⁵⁻⁶ POCD is important because it affects quality of life mentally, physically, socially and financially. Criteria to check POCD is based on comparing the cognitive functions pre-operatively and post-operatively. MMSE score is used to analyse and measure the cognitive functions.¹⁴

As the sensitivity to anaesthetic drugs increases in this group, lesser dose of medication is required and recovery after general anaesthesia is slow.² Our main goal in perioperative period in elderly individuals is speedy recovery without functional declination. And for that, detailed pre-operative assessment of vital organ systems is required and accordingly, proper selection of anaesthetic technique, anaesthetic drug and its dosage is very important.¹⁰⁻¹²

Methods and Approach

Prospective, randomised controlled, interventional, single blind study was conducted after obtaining permission from Institutional Ethical Committee. Written and informed consent was taken from patients. Total 70 patients of American Society of Anaesthesiologists (ASA) physical status I, II and III, aged 65 years and above undergoing major surgeries under General Anaesthesia with sevoflurane or desflurane were randomly allocated in two equal groups (n = 35 in each group). Group S consisted of 35 patients who were given sevoflurane and Group D consisted of 35 patients who were given desflurane. In my study, patients which gave consent for the study, age more than 65 years, ASA physical status I, II and III and MMSE score above

27 were included for the study. While the patients who refused to give consent, ASA grade IV and V, age below 65 years, obese (body mass index >30), MMSC score below 27, having known allergy to anaesthetic drugs, hemodynamically and/or clinically unstable, alcoholic, having neurological or psychiatric disorders were excluded from the study.

After taking informed and written consent, Standard monitors were applied, Two IV lines were secured, Injection fentanyl (2 µg/kg), ondansetron (0.15mg/kg) and glycopyrrolate (0.004 mg/kg) as premedication were given to all the patients. After pre-oxygenation with 100% oxygen for 3mins, induction of anesthesia was done with injection propofol (2mg/kg), Inj. Vecuronium (0.1mg/kg) given. Intubation done with conventional laryngoscope. Anesthesia was maintained with: in Group D: 50% oxygen, 50% nitrous oxide, desflurane (5-6%), Group S: 50% oxygen, 50% nitrous oxide, sevoflurane (2-3%), Intermittent IV Vecuronium (0.05 mg/kg) was given. Sevoflurane or desflurane were discontinued when skin closure was started and time noted. Residual neuromuscular blockade was reversed with inj. neostigmine 0.05 mg/kg and glycopyrrolate 0.008 mg/kg IV. During recovery, the time to open the eyes, follow verbal commands, extubation, orientation, sitting, standing and discharge from the recovery room was noted. Side effects like vomiting, nausea, etc. were also noted. Post op MMSC score at 1, 3, and 6 hours were noted. Emergence time (Time of anaesthetic discontinuation to eye opening), Extubation time: (Time of anaesthetic discontinuation to extubation), Recovery time: (Time of anaesthetic discontinuation to ability to recall name, date of birth were also noted. (Aldrete scoring evaluated at every 5mins till maximum score of 10 reached and after that Cognitive behaviour evaluation with MMSE done).

Study End Point: After six-hours post operatively.

Sample size of 70 determined by using power analysis on assumption that incidence of reduction of cognitive functions post-operative after general anaesthesia would be 50% (reduction of more than 70% is clinically significant). Data was collected and analysed by using SPSS (statistical package for social science) for Windows 10.0. Data was compiled and mean value with variability was expressed as standard deviation SD. For parametric data, unpaired t-test and ANOVA (analysis of variance) tests were used, and for non-parametric data chi-square test was used and p value obtained. P value less than 0.05 suggested statistically significant difference.

Table 1: Demographic Data.

Parameters	Group D	Group S	P value
Age years	69±2	70±3	-
BMI(kg/m ²)	22,6±1.1	23.5±1.8	-
Sex Male: Female	14:16	13:17	-
Duration of surgery (min)	98.5±9.39	94.5±7.69	0.0762
Duration of anesthesia(min)	107.83±8.06	110.33±9.27	0.2696

Result

70 patients of more than 65 year of age, both genders and their demographic data was studied.

As per Table. 1 Demographic data like age, gender, BMI, duration of surgery, duration of anesthesia was clinically insignificant.

Table 2: Immediate recovery.

Parameters	Group D n = 35	Group S n= 35	P value
Eye opening time (min)	5.03 ± 0.80	7.47± 0.86	<0.0001
Extubation Time (min)	6.96 ± 0.80	9.20± 0.76	<0.0001
Follow verbal command time (min)	8.76 ± 0.85	11.87± 1.04	<0.0001

Table 3: side effect.

	Group D	Group S
Dizziness	0	4
Headache	3	1
Nausea	5	3
Vomiting	2	1

As per data of table 2, we compared eye opening time, extubation time and following verbal command time in both the groups, group D shows faster immediate recovery parameters, as compare to group S and P value of data shows statistically significant difference. Hence group receiving desflurane shows faster recovery compare to sevoflurane.

Table 3 shows side effects noticed post-operatively. In Group D, 3 patients had complain of headache, 5 patients had complain of Nausea and 2 patients had vomiting for 1-2 times while among Group S, 4 patients had dizziness, 1 patient had complain of headache, 3 patients had nausea and amongst them 1 patient had vomiting. No life threatening side effects were noticed in either of the drugs. Thus, both the drugs are safe for patients.

Table 4: MMSE score.

	Group D	Group S	P value
Baseline (pre op)	28.97± 0.71	28.67±0.71	0.107
1 hour post op	27.57± 1.22	27.03±1.06	0.072
3 hour post-op	27.97 ± 0.96	27.70±0.83	0.248
6 hour post-op	28.77 ± 0.77	28.50±0.62	0.140

Table 4 shows MMSE score after 1 hr, 3 hr and 6 hr post-operatively. Average MMSE Score of Group D at 1 hour was 27.57±1.22 whereas of Group S was 27.03±1.06 which is statistically insignificant. Similarly, after 3 hours and 6 hours post-operatively the difference between the average MMSE score of both the groups was statistically insignificant.

Amongst the patients on desflurane, at 1 hour post operatively, 5 patients had score less than 27, while amongst those on sevoflurane, at 1 hour post operatively, 10 patients had score less than 27. At 3 hours postoperatively, 2 patients from Group D and 3 patients from Group S had score less than 27 and at 6 hours post-operatively, all the 70 patients had score more than 27 and had normal cognitive function. But this data is not statistically significant.

Discussion

Brain function is altered immediately after general anaesthesia. Memory loss, disorientation, impairment of attention and reaction time are altered. In some cases, complete amnesia also can occur post-operatively.

Short term cognitive dysfunction is not uncommon few hours or days after surgery. To assess we used MMSE screening test. And for evaluating immediate recovery we used eye opening time, extubation time, and following verbal command time.

In our study, results show that immediate recovery after general anaesthesia is faster in group receiving desflurane as a maintenance anaesthesia. Parameters of immediate recovery like eye opening time, extubation time and following verbal command time post-operatively was average 2-3 min faster in group receiving desflurane as compared to sevoflurane and this difference is statistically significant. Such 2-3 min difference might not affect adult population but it definitely affects geriatric patients with or without co-morbidity.

As per J. E. Heavner² and Chen PL⁷ study, desflurane shows faster recovery as compared to any other inhalational anaesthetic agent because

of low lipid solubility and low blood/gas partition coefficient (1.29 ± 0.05). So desflurane shows early washout from the lung hence shows early recovery. In both the studies, they used eye opening as a sign of immediate recovery. Magni, Giuseppina¹⁷ study results show time to extubation was 2 min faster and time to recovery was 6 min faster in group receiving desflurane as compared to sevoflurane in neuro surgery. So definitely desflurane shows excellent immediate recovery after anaesthesia due to its property and that is why desflurane is the preferable drug for day care surgeries. Minimal side effects are noted with both the agents. Desflurane is also cost effective drug. J. Golembiewski¹⁸ study and Robercht de medts¹⁹ study results show that desflurane is cheaper than sevoflurane. At equivalent MAC value the cost of desflurane is one third that of the cost of sevoflurane.

For cognitive function, in our study, pre-operative MMSE score of patients acts as a control for each individual participant. And at the end of the study we compared post-operative score at different times with pre-operative scores in both the groups. We chose elderly population for study because cognitive dysfunction is common in elderly age group. Results of our study shows that immediate post-operative MMSE score of group receiving desflurane as maintenance anaesthesia was higher than other group receiving sevoflurane but not statistically significant.

After analysis of data, both sevoflurane and desflurane are equally good for the geriatric patients. They do not affect cognitive functions. After 1st hour post-operatively MMSE score of patient given desflurane is more as compared to sevoflurane but that was not statistically significant. For immediate recovery desflurane is inhalational drug of choice but for POCD both the drugs are equally good. In Xiaoguang Chen³ study, similar results were obtained. They used MMSE score for evaluation of cognitive function in elderly undergoing general anaesthesia for total knee and hip replacement and they concluded that emergence from the anaesthesia was rapid with desflurane but for cognitive impairment they failed to conclude which drug is better.

We used MMSE screening test because it has high validity and high reliability and also ease of application for elderly.²¹ This test concentrates only on cognitive functions and excludes mood and mental stability and abnormal experience after general anaesthesia. Edwards H 22, noticed cognitive dysfunction after 2 days to 7 days but maximum at 4th day of general anaesthesia but

now recent study Chung F 23, suggests that by using recently emerging inhalational anaesthetic agents, cognitive dysfunction is noticed on first post-operative day only.

Further study is required to collect more precise data. Statistically insignificant difference in this study does not exclude the possibility of cognitive dysfunction. May be larger group for study is required, or more post-operative time period for assessment or standard tool of investigation for POCD other than screening test like MMSE is required.

Conclusion

In our study, we conclude that signs of recovery from general anaesthesia like eye opening; extubation and following of verbal commands was faster with desflurane than sevoflurane which is statistically proven, But post-operative cognitive dysfunction was lesser in desflurane than sevoflurane which was insignificant.

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