Original Research Article

Indian Journal of Anesthesia and Analgesia
2018; 5(4): 623-629
DOI: http://dx.doi.org/10.21088/ijaa.2349.8471.5418.19

An Observational Study to Compare Recovery of Elderly Patients from General Anaesthesia with Sevoflurane or Desflurane

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Abstract

Background: The clinical study was undertaken to compare the recovery of elderly patients from general anaesthesia with sevoflurane or desflurane with reference to spontaneous eye opening, obeying verbal commands, recall of name, squeezing fingers, time to extubation and orientation and Modified Aldrette Score.

Material and Method: Study was conducted on 60 patients of either sex, belonging to ASA I, II and III posted for elective surgeries. Age of the patients were above 60 years and were divided into groups of 30 each (group D and group S).All patients were pre medicated with inj. glycopyrrolate 0.004 mg/kg i.v, inj. fentanyl 1microgram/kg i.v., inj ondansetron 0.1 mg/kg i.v., inj.ranitidine 50mg i.v. After preoxygenation with 100% for 5 minutes, patients were induced with injection propofol 1-2 mg/kg i.v. and intubation facilitated with injection succinyl choline 1.5mg/kg i.v. Anaesthesia was maintained with either desflurane (group D) or sevoflurane (group S) in combination with N_2O 50% in O_2 50% . All patients were mechanically ventilated. Both group received Fresh gas Flow of 4 lit/min for first 10 mins. After 10 mins FGF was reduced to 2 lit/min. with desflurane and sevoflurane adjusted so as to maintain hemodynamic parameter within 20% of baseline values or according to clinical parameters. Muscle relaxation was maintained by using injection atracurium i.v (loading dose) and top up doses were guided by PNS. Desflurane/Sevoflurane and N_2O were turned off after the last skin suture. Neuromuscular blockade was reversed by inj. neostigmine 0.05 mg/kg and inj. glycopyrrolate 0.008 mg/kg and patients were extubated . Time to extubation was recorded as time from discontinuation of inhalation to extubation. Pulse rate (P.R), systolic blood pressure (SBP), Diastolic blood pressure (D.B.P), oxygen saturation (SpO_2), electrocardiography (ECG) were observed throughout the surgery at every 10 mins. Recovery was assessed in the PACU by using the Modified Alderete Score every 5 minutes for intial 10 minutes and then every 10 minutes till 60 minutes.

Result: The recovery parameters of spontaneous eye opening, obeying verbal commands, recall of name, squeezing of fingers, time to extubation and place of stay were significantly shorter in patients of Desflurane group as compared to patients of Sevoflurane group ($p<0.05$). Patients given desflurane achieved Modified Aldrete Score of 9 significantly faster than patients given sevoflurane.

Conclusion: We concluded that although sevoflurane and desflurane provided similar intra-operative conditions, desflurane provided more rapid recovery and the return of cognitive functions in the early post operative period.

Keywords: Desflurane; Sevoflurane; Elderly.

Introduction

With the development of society to the aging, more and more elderly people face Surgery and anaesthesia related problems. In elderly patients, due to organ degeneration; heart, lung, brain and reduced reserve function of important organs; have poor tolerance to anaesthetics.

At the same time elderly patients with declined liver and kidney function, drug clearance cycle is extended accordingly. Therefore, the choice of anaesthesia maintaining drugs in elderly patients has the top priority [1].

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Received on 18.01.2018, **Accepted on** 17.02.2018

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 [2]. 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 anaesthesia [3].

Postoperative cognitive dysfunction (POCD) is defined as postoperative psychomotor disorder [4]. Anaesthetic agents and physiological changes resulting from it are associated with psychomotor function disorder [5,6]. 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.Postoperative cognition function are affected by anaesthetic drug and their residual effects can alter the central nervous system [7,8,9]. 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].

More rapid recovery from prolonged anaesthesia may be an advantage in the elderly in whom cognitive impairment (e.g. delirium, confusion) is a problem during recovery [11].

Eger and colleague speculated that the lower partition coefficients of desflurane favour sits more rapid elimination from the body and additional factors such as effects of degradation products of sevoflurane might delay recovery from sevoflurane after longer anaesthesia [12].

Chen and colleagues1 found that compared with sevoflurane, desflurane gave a faster emergence from anaesthesia and less time in the PACU in elderly patients undergoing total knee or hip replacement. However, recovery of cognitive function, measured by the Mini Mental State test, was no different between desflurane and sevoflurane [13].

Discharging patients from Post Anaesthesia Care Unit (PACU) depends upon Modified Aldrete Score [14]. It consists of 6 factors taken into account by the clinician that checks whether the patient can be released or not. There are 6 questions, each with 3 choices that are given different scores. The score values range from 0 to 12, 0 being the patient is closest to the anesthesia state, 9 being the guideline to discharge and the closer the score gets to 12, the closest to all anesthetic being worn off from the system.

Hence, we decided to carry out the present observational and interventional study to compare the recovery profile of sevoflurane and desflurane in elderly patients undergoing surgery under general anaesthesia using Modified Aldrete score monitoring scale.

Methods

After approval from institutional ethical committee, this observational and interventional study was conducted at S.B.K.S. Medical institute and research centre over a period of one year and six months. Primary aim of our study was to observe recovery profile in elderly patients undergoing general anaesthesia with desflurane and sevoflurane using modified aldrete score.

We selected patients who were ready to give informed written consent, aged 60 years and above of both genders, belonging to ASA Grade I, II and III, posted for planned surgeries under general anaesthesia expected to last more than1 hour. Patients with severely compromised respiratory diseases/ cardiac disease/renal and hepatic dysfunction, Morbid obesity, Family history of Malignant Hyperthermia, history of exposure to general anaesthesia within last one week were excluded from the study.

After obtaining informed and written consent from patients, patients were randomly allocated by "chit method" into 2 groups of 30 each. All the patients in group D received desflurane and group S received sevoflurane as an inhalational agent. Pre-anaesthetic checkup comprising of detailed history and systemic examination, thorough airway examination and investigations (Complete blood count , Random blood sugar, Serum electrolytes, Coagulation profile, Liver and renal function tests, Chest x-ray, Electro-cardiography, 2-D echo if indicated) was carried out. All the Patients were kept nil by mouth foratleast 6 hours prior to surgery and were given tablet Alprazolam 0.25mg orally on the night before surgery. After taking patient inside operation theatre baseline vital parameters (Heart rate, NIBP, SpO_2, ECG were recorded. After securing 20 G intravenous catheter, injection (inj.) Ringer Lactate was started. Patients were Premedicated with inj. glycopyrrolate 0.004 mg/ kg, inj. fentanyl 1microgram/kg, inj. Ondansetron 0.1 mg/kg and inj.ranitidine 50mg intravenously (i.v). After preoxygenation with 100% for 5 minutes, patients were induced with inj. propofol 1-2 mg/kg i.v (till loss of eye-lash reflex) and intubation was facilitated with inj. succinyl choline 1.5mg/kg i.v. After intubation, Anaesthesia was maintained with either desflurane (group D) or sevoflurane (group S)

in combination with N_2O 50% in O_2 50%. All patients were mechanically ventilated.

Both the groups received Fresh gas Flow (FGF) of 4 litre/minute for first 10 mins, with desflurane dial concentration 3-6% in group D and sevoflurane dial concentration 1-3% in group S. After 10 minutes, FGF was reduced to 2 litre/minute with desflurane and sevoflurane adjusted so as to maintain hemodynamic parameter within 20% of baseline values or according to clinical parameters. Muscle relaxation was maintained by using inj. Atracurium 0.5 mg/kg i.v (loading dose) and 0.1 mg/kg incremental dose as guided by Peripheral nerve stimulator. All patients were mechanically ventilated by anaesthesia work-station. N_2O and inhalational agent were turned off after the last skin suture. Neuromuscular blockade was reversed with inj. Neostigmine 0.05 mg/kg and inj. Glycopyrrolate 0.008 mg/kg i.v., once spontaneous respiration recovered and patients were extubated after fulfilment of extubation criteria. After the discontinuation of inhalation anaesthetics, recovery was assessed with Spontaneous eye opening, obeying verbal commands, recall of name, squeezing fingers, time to extubation and orientation. Time to extubation was recorded as time from discontinuation of inhalational agent to extubation. Intermediate recovery was assessed in PACU (post anaesthesia care unit) by using the modified alderete score every 5 minutes for initial 10 minutes and then every 10 minutes till 60 minutes. Heart rate, NIBP, SpO_2, ECG were observed throughout the surgery. Patients were observed for side effects like nausea, vomiting, headache and treated accordingly.

Statistical Analysis

Keeping the power of study as 80% and confidence limit at 95%, the minimum sample size calculated by using the formula ($n= (Z\alpha/2+Z\beta)2 * (p1(1-p1)+p2(1-p2)) / (p1-p2)2$) came around 30 in each group. Hence, we studied total 60 patients randomly allocated into two groups of 30 each. Quantitative data was presented with the help of Mean and Standard deviation. Qualitative data was presented with the help of frequency and percentage table.

Association among the study groups is assessed with the help of Chi-Square test. 'p' value less than 0.05 is taken as significant. Appropriate statistical software; MS Excel, SPSS ver. 20 was used for statistical analysis. Graphical representation was prepared in MSExcel 2010.

Observation and Results

In our study, demographic data (age, gender, ASA status) were statistically comparable to each other in both groups (Table 1). Duration of surgery and anaesthesia were also comparable between both the groups (Table 2). Immediate recovery parameters including spontaneous eye opening, obeying verbal commands, recall of name, squeezing of fingers, time to extubation and orientation to place of stay were significantly shorter in patients of Group D compared to Group S (p value <0.05) (Table 3).

Intermediate recovery was assessed using modified aldrete score at 5, 10, 20, 30, 40, 50 and 60 minutes after arrival to PACU. Patients in group D achieved modified aldrete score of 9 or more at 5minutes after reaching PACU while in group S score of 9 or more was achieved at 20 minutes after reaching PACU. Modified aldrete score was significantly higher in group D at 5, 10 and 20 minutes. (p value <0.05) (Table 4). After 20 minutes modified aldrete score was comparable between two groups. Hemodynamic parameters (heart rate, SBP, DBP and MAP and SpO_2

Table 1: Demographic data

	Group D	Group S	p value
Age (Y)	70.33 ± 7.56	71.96 ± 6.85	>0.05
Gender (M/F)	16/14	18/12	>0.05
ASA grade (I/II/III)	14/9/7	12/10/8	>0.05

Y-Years M-Male F- Female, Age presented as mean±SD
Gender and ASA grade presented as number of patients

Table 2: Duration of surgery and anaesthesia

	Group D	Group S	p value
Duration of surgery (m)	62.32±11.78	64.98±12.26	0.4
Duration of Anesthesia (m)	81.14±12.24	82.34±13.47	0.71

m - minutes

were comparable between both groups throughout the study (graph 1 and 2). Total 3 patients in group D had drowsiness in comparison with 6 patients in group S. Nausea/vomiting was not seen in both groups. Headache was seen in 1 and 2 patients in group D and group S respectively. Although the incidence of side effects was more in Group S, statistically there was no significant difference between the two groups (Table 5).

Table 3: Comparison of Recovery Parameters

Parameters	Group D	Group S	p value
Spontaneous Eye Opening	4.9±1.5	7.1±2.6	0.0002*
Obeying verbal commands	6.3±2.6	8.2±3.1	0.0127*
Recall of name	5.4±1.6	7.8±2.5	0.0001*
Squeezing Fingers	6.8±2.1	9.3±2.2	0.0001*
Time to Extubation	5.2±3.1	8.3±3.4	0.0005*
Place of Stay	5.8±1.9	8.2±2.2	0.0001*

All parameters presented in minutes as mean±SD, *p value <0.05 :statistically significant

Table 4: Comparison of Modified Aldrete Score among study groups

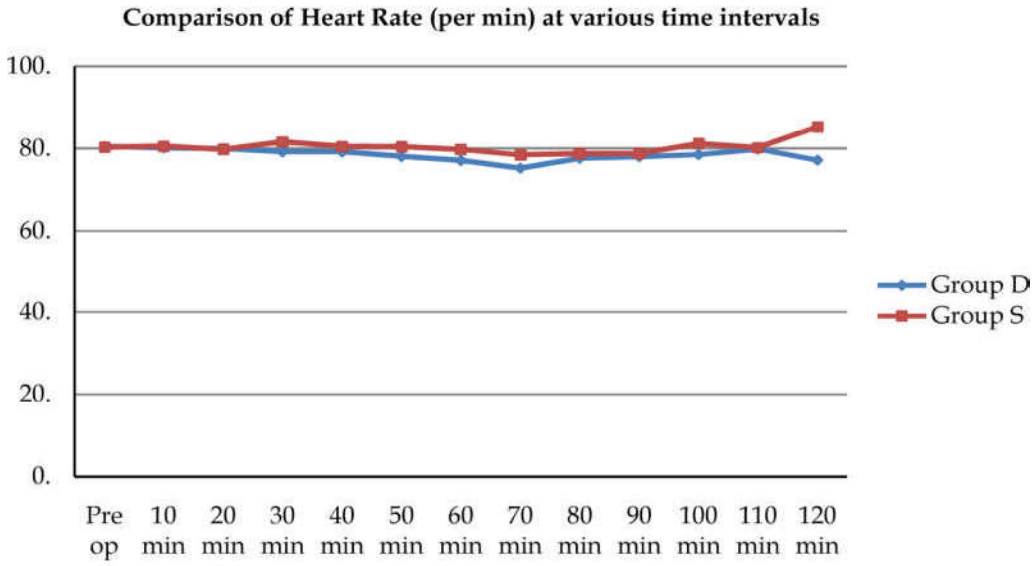
Modified Aldrete Score	Group D	Group S	p value
Arrival	8.5±0.4	8.1±0.6	0.0036*
After 5 mins	9.1±0.4	8.7±0.4	0.0003*
After 10 mins	9.3±0.2	8.9±0.4	0.0001*
After 20 mins	9.5±0.2	9.4±0.2	0.0577
After 30 mins	9.6±0.2	9.5±0.1	0.173
After 40 mins	9.6±0.2	9.5±0.1	0.173
After 50 mins	9.8±0.1	9.7±0.4	0.1892
After 60 mins	9.9±0.5	9.8±0.1	0.0359

All parameters presented as mean±SD, * p value <0.05 :statistically significant

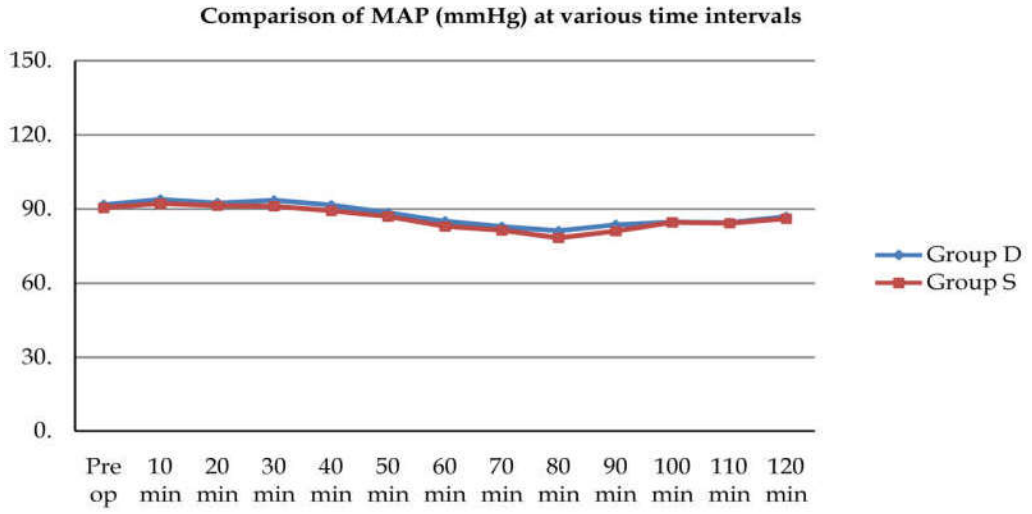
Table 5: Comparison of Side Effects among study groups

Side Effects	Group D N (%)	Group S N (%)	p value
Drowsiness	3 (10%)	6 (20%)	>0.05
Nausea/Vomiting	0 (0%)	0 (0%)	>0.05
Headache	1 (3.3%)	2 (6.7%)	>0.05

N: number of patients



Graph 1: Comparison of Heart Rate (per min) at various time intervals



Graph 2: Comparison of Mean Arterial Pressure MAP (mmHg) at various

Discussion

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. 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 anaesthesia [3].

The solubility of desflurane compared with sevoflurane suggests more rapid recovery from desflurane anaesthesia. This could be important after prolonged anaesthesia and fast recovery may be advantageous in the elderly where slow recovery of mental function is a concern. We compared emergence from desflurane vs sevoflurane in elderly patients undergoing two or more hours of anaesthesia [15].

The present observational study was undertaken to compare the recovery profile of sevoflurane and desflurane in elderly patients undergoing surgery under general anaesthesia. The recovery parameters of spontaneous eye opening, obeying verbal commands, recall of name, squeezing of fingers, time to extubation and orientation to place of stay were significantly shorter in patients of Desflurane group as compared to patients of Sevoflurane group. Patients given desflurane achieved Modified Aldrete Score of 9 significantly faster than patients given sevoflurane.

Sevoflurane, a halogenated ether is a highly volatile anesthetic which hasfaster induction due to low blood: gas partition coefficient (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 [16,17,18].

Jadhav PK in a study, compared postoperative cognitive function and the time to specific recovery events in elderly patients anaesthetized with sevoflurane or desflurane. Though they used MMSE for assessment of recovery profile, this study concluded that Desflurane was marginally better anesthetic agent in terms or recovery to sevoflurane [19].

Deepak TS et. al. also found similar result in their prospective study. They compared post-Operative Cognitive Functions after General Anesthesia with Sevoflurane and Desflurane in South Asian Elderly patients. The recovery parameters of spontaneous eye opening, obeying verbal commands, recall of name, squeezing of fingers, time to extubation and orientation to place of stay were significantly shorter in patients of Desflurane group as compared to patients of Sevoflurane group. Also that, patients given desflurane achieved Modified Aldrete Score of 9 significantly faster than patients given sevoflurane.

They also assessed cognitive function at 6 hour postoperatively which was comparable in both the groups. They concluded that faster early recovery was associated with desflurane in elderly patients. However, postoperative recovery of cognitive function was similar with both volatile anaesthetics [20].

Chen X et. al. found that compared with sevoflurane, desflurane gave a faster emergence from anaesthesia and less time in the PACU in elderly

patients undergoing total knee or hip replacement. However, recovery of cognitive function, measured by the Mini Mental State test, was no different between desflurane and sevoflurane in their study [13].

Ergonenc J et. al. found higher MAS with desflurane initially and concluded that desflurane provide better quality and more rapid recovery than sevoflurane [21].

Xuefeng et al compared sevoflurane and desflurane in recovery of older patients undergoing thoracoscopic lobectomy and found that desflurane can shorten extubation and recovery time and thus improve the time of recovery [1].

Heavner JE et. al. compared desflurane with sevoflurane and suggested more rapid early recovery from desflurane anaesthesia. This finding is similar to our study but in contrast to our study, intermediate recovery profile was similar with both inhalational agents in their study [15].

The pharmacokinetic properties (lower blood gas partition co-efficients 0.45 and 0.65 respectively) of desflurane and sevofluranefavours better intra-operative hemodynamics and rapid post-operative recovery.

The haemodynamic variables (pulse rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, SpO_2) were comparable in both the groups and there was no statistically significant difference. This correlates to the studies of Kaur A et. al. [22], Nathanson MH et. al. [23] and Jindal R et. al. [16].

In contrast to previous volunteer studies [24,25] in our study desflurane did not produce an increase in HR above baseline levels, nor the tachycardia which has been reported after a sudden increase in the inspired concentration of desflurane. It was observed that although the incidence of side effects was more in Sevoflurane group as compared to Desflurane group there was no significant difference between the two groups. The limitation of our study was that we did not observe for recovery of cognitive function at the time of discharge from the hospital. So, we cannot comment about the effect of desflurane and sevoflurane on cognitive function. Also that, our study patients had surgery of 1or 2 hour duration. It might get different result for longer duration of exposure to inhalational agents.

Conclusion

From our study we can conclude that desflurane has better early and intermediate recovery profile in elderely patients with stable hemodynamic parameters. This property of desfurane can help in reducing the incidence of postoperative cognitive dysfunction in elderely patients after general anaesthesia.

Conflict of Interest

There is no conflict of interest.

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