Comparision of Early Cognitive Recovery in Patients Undergoing Elective Abdominal Surgeries using Sevoflurane Versus Desflurane

Lipika Baliarsing[1], Mangesh Gore[2], Deepika Teckchandani[3]

ABSTRACT

Introduction: Cognitive impairment is a significant problem in patients during the early postoperative period. The use of volatile anaesthetics with rapid elimination may reduce postoperative cognitive dysfunction in surgical patients with faster recovery from general anaesthesia. Sevoflurane and Desflurane have pharmacokinetic properties that favour rapid emergence and less postoperative cognitive impairment. This study compares cognitive recovery in elective abdominal surgeries using sevoflurane versus Desflurane.

Material and Method: 60 American Society of Anaesthesia grade I and II patients for elective abdominal surgeries requiring general anaesthesia were divided in two groups, group S (Sevoflurane) and group D (Desflurane) randomly. Cognitive recovery of patients was studied using Hindi Mini Mental Status Examination till they are shifted out of post anaesthesia care area**.**

Results: Desflurane causes recovery from anaesthesia 2 to 3 minutes earlier than sevoflurane but cognitive recovery is similar with both the agents. [In recovery profile when time to open eyes, time to extubation and time to orientation are compared, desflurane was found to be significantly better as compared to sevoflurane. When the Hindi Mini mental Status Examination scores were compared at intervals of 1hour, 3 hours and at 6 hours there is statistically no significant difference.

Conclusion: Desflurane is associated with faster emergence from anaesthesia compared to Sevoflurane but the early cognitive recovery is similar in both groups

Keywords: Desflurane, Hindi mini mental status examination, recovery profile, Sevoflurane

INTRODUCTION

Abdominal surgeries are most commonly performed under general anaesthesia. Inhalational agents like Desflurane, Sevoflurane, Isoflurane, and Halothane are used to maintain the state of anaesthesia and have a unique route of administration and useful pharmacological properties.

Cognition is the set of all mental abilities and processes related to attention, knowledge, memory, reasoning, computation, decision making, comprehension and production of language. Cognitive processes use existing knowledge and generate new knowledge.[1]

Cognitive impairment (e.g. delirium, confusion) is a significant problem in patients during the early postoperative period. The occurrence of postoperative delirium in the elderly can result in increased morbidity, delayed functional recovery, and thus prolonged hospital stay. This causes immobilisation causing further complications like decubitus ulcers, pneumonia or thrombosis.[2-5]

The use of volatile anaesthetics like sevoflurane or desflurane that are rapidly eliminated with least metabolic breakdown may reduce postoperative delirium and cognitive dysfunction in surgical patients thereby facilitating a faster recovery from general anaesthesia.

Mini-Mental State Examination (MMSE) a bedside test, of cognitive function by Folstein, has been extensively used in clinical practice and research. The MMSE is an easily administered 30-point test of cognitive function, includes factors viz. orientation, working memory (e.g., spell a word backwards), episodic memory (orientation and recall), language comprehension, naming, and copying.[6,7] Hindi Mini Mental Status Examination, the Hindi version of the MMSE is a cognitive screening instrument for a largely illiterate rural population in India. Within these guidelines, the Indo-US Study group places no further restrictions on the use of the HMSE.[8]

Aim of the study was to compare the cognitive recovery in elective abdominal surgeries using sevoflurane versus Desflurane.

MATERIAL AND METHODS

After taking institutional ethics committee approval, we studied 60 patients of American society of Anaesthesiology grade I and II, aged between 18 to 60 years, undergoing elective abdominal surgeries were randomised into two groups of 30 each. Subjects were selected based on inclusion and exclusion criteria. Patients with clinically significant cardiovascular, respiratory, hepatic, renal, neurologic, psychiatric, metabolic diseases and impaired hearing were excluded from the study. On the day of surgery, after obtaining written informed consent in the preoperative holding area, the Hindi Mini-Mental State Examination (HMSE) test was conducted. The maximum score for HMSE being 31 any score less than 25 indicates cognitive impairment. Patients were divided randomly in two groups, Group S (received Sevoflurane) and Group D (received Desflurane).

Inside the operating room all patients were attached to Electrocardiogram (ECG), Non-invasive Blood Pressure (NIBP) and pulse oximetry (SPO_2). All the patients were given inj. glycopyrrolate 0.08 mg/kg, inj. midazolam 0.03 mg/kg and inj. fentanyl 2 ug/kg, Inj. ondansetron 100 ug/g was given to all patients to avoid post-operative nausea and vomiting.

After adequate preoxygenation, (induction was done with inj. propofol.Tracheal intubation was facilitated by inj.vecuronium 0.08-0.1 mg/kg) Direct laryngoscopy was done and trachea intubated. Patients were attached to end tidal Carbon dioxide

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($EtCO_2$) and to respiratory gas monitor (RGM). Controlled ventilation was started with oxygen - air mixture to achieve fiO_2 of 0.4 with a closed circuit. Anaesthesia was maintained in Group S patients with Sevoflurane with a dial setting of 2-4 % to achieve a MAC of 1.0 -1.2 with flows of 1.5-2 L/ min. and in group D patients anaesthesia was maintained with Desflurane to achieve a MAC of 1.0 -1.2 with a dial setting of 4-6%. To facilitate IPPV, neuromuscular blockade was achieved with a non-depolarising muscle relaxant inj. vecuronium. Inj. paracetamol 10-15mg/kg was given to all patients for analgesia. ECG, Pulse rate, Blood pressure, SPO_2 and MAC of the inhalational agent were monitored. Sevoflurane or Desflurane were discontinued gradually at the start of skin closure, and air was discontinued at the end of surgery. Once patients achieved spontaneous breathing neuromuscular blockade was reversed with Inj. glycopyrrolate 0.008 mg/kg and Inj. Neostigmine 0.05 mg/kg. Patients were extubated after return of oropharyngeal reflexes.

The times from reversal to eye opening, obeying commands (e.g., squeezing the investigator's hand), tracheal extubation, as well as the times to orientation to name and place were assessed. The anaesthesia durations from the start of induction to discontinuation of inhalational agents and surgery duration (from surgical incision to skin closure) were also recorded.

At 1, 3, 6 hours after the end of anaesthesia, the patient's early cognitive function was assessed by using HMSE.

In the recovery room, Post-operative recovery profile using Modified Aldrete Scoring System was recorded. A score of greater than 9 at the end of the study indicated that the patient was in optimal condition for discharge from recovery room.

STATISTICAL ANALYSIS

After data collection, data entry was done in Excel. Data analysis is done with the help of appropriate SPSS Software version 15 and Sigma Plot Version 12. Quantitative data is presented with the help of Mean, Standard Deviation, Median and IQR, comparison among study group will be done with the help of Unpaired T test or Mann-Whitney test and comparison within group is done with Wilcoxon Signed Ranks Test as per results of Normality test.Qualitative data is shown as a Frequency and Percentage tables, association among study parameters is assessed with the help of Chi-Square test (Fischer Exact test for 2*2 tables).P value less than 0.05 is taken as significant level.

RESULT

In recovery profile when time to open eyes, time to extubation and time to orientation are compared, desflurane was found to be significantly better as compared to sevoflurane.

When the HMSE scores were compared at intervals of 1hour, 3 hours and at 6 hours there is statistically no significant difference in the HMSE scores at these time intervals between the two groups. p values at 1 hour, 3 hour and 6 hr. were 0.82, 0.78, and 0.19 respectively.

100 % patients of either group had post op Modified Aldrete Score greater than or equal to 9 at the time of discharge from PACU.

DISCUSSION

The pathogenesis of postoperative cognitive dysfunction is unclear; however, factors such as age, low baseline cognition, contribute to this problem. Residual levels of anaesthetic agents can affect cognition and therefore choice of the agent is important. Agents with a faster clearance and minimal metabolism may offer advantages in patients.

Older anaesthetic agents like ether and halothane were associated with longer times to recovery from general anaesthesia [blood gas coefficient for halothane is 2.5 and ether is 12] and greater incidence of post-operative side effects like nausea, vomiting and risk of aspiration. These were associated with longer times to emergence and achievement of Aldrete scores more than 9 thus delayed discharge from PACU, which were not desirable.

Patients in our study were randomized into two groups, to receive desflurane or sevoflurane. These volatile anaesthetics, possess low blood-gas partition coefficients, [Blood gas partition coefficient for desflurane and sevoflurane are 0.45 and 0.65 respectively], and contributing to a faster recovery from anaesthesia compared with the traditional volatile anaesthetics and hence are widely used now.

Amongst the two volatile agents i.e. sevoflurane and desflurane, we found that in our study the recovery from anaesthesia was faster with desflurane than sevoflurane. Patients receiving

Study Parameter	Desflurane				Sevoflurane				Unpaired T Test	P Value
	Mean	Std. Dev	Median	IQR	Mean	Std. Dev	Median	IQR		
Extubation Time (Min)	6.98	0.90	7.00	1.50	10.07	2.05	10.00	3.25	-7.537	<0.05

Table-1: Comparison of extubation time

Study parameter	Desflurane				Sevoflurane				Unpaired t test	P value
	Mean	Std. Dev	Median	IQR	Mean	Std. Dev	Median	IQR		
Time to orientation (mins)	9.37	0.83	9.00	1.00	13.47	2.36	13.75	4.13	-8.978	<0.05

Table-2: Comparison of time to orientation

Hmse score	Desflurane				Sevoflurane				Mann-whitney test	P value
	Mean	Std. Dev	Median	IQR	Mean	Std. Dev	Median	IQR		
Pre op	29.30	1.15	29.00	2.00	29.60	1.04	30.00	1.25	-1.032	0.302
1 Hr	26.27	1.34	26.00	2.00	26.30	1.60	26.00	3.00	-0.219	0.827
3 Hr	28.10	1.42	28.00	2.25	28.17	1.21	28.50	2.00	-0.273	0.785
6Hr	29.47	0.82	29.00	1.00	29.73	0.83	30.00	1.00	-1.290	0.197

Table- 3: comparison of hmse scores between desflurane and sevoflurane

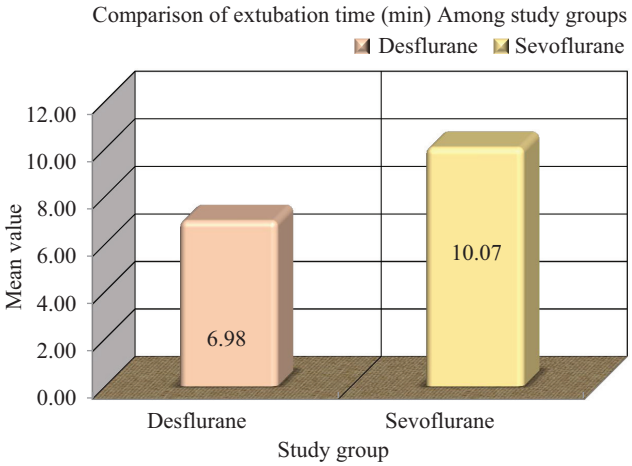

Figure-1: Show the mean time to extubation for the Desflurane (6.98 mins) and sevoflurane (10.07 mins) groups. The time to extubation was significantly better with Desflurane compared to sevoflurane (p= < 0.05).

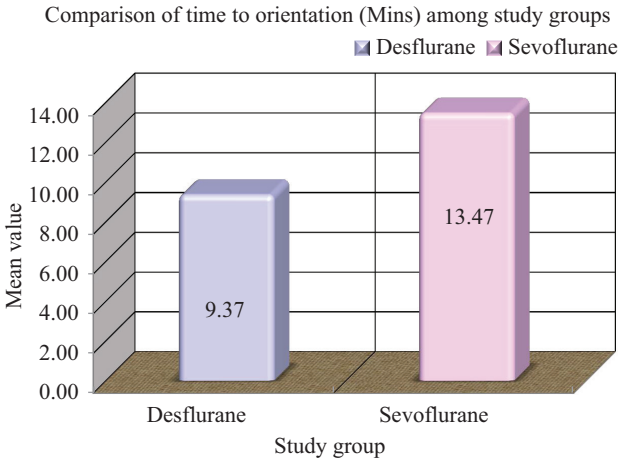

Figure-2: Show the mean time to orientation for the Desflurane (9.37 mins) and sevoflurane (13.47 mins) groups. The time to orientation was significantly better with Desflurane compared to sevoflurane (p= < 0.05).

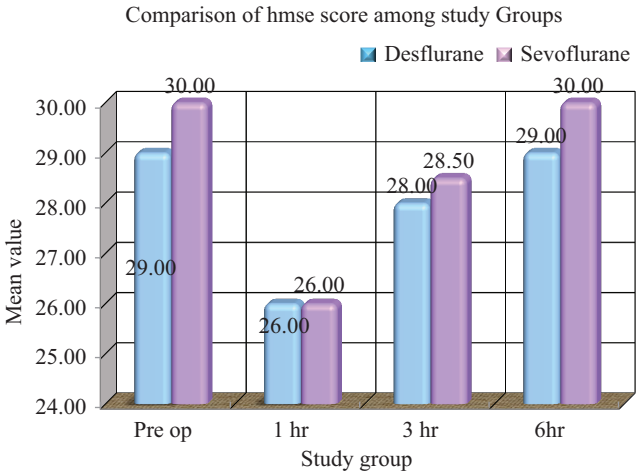

Figure-3: Show the HMSE scores at various time intervals in the study groups. There is statistically no significant difference in the HMSE scores at these time intervals between the two groups. p values at 1 hr., 3 hr. and 6 hr. were 0.827, 0.785, and 0.197 respectively.

desflurane were extubated, followed commands and were oriented 2.0-3.0 minutes earlier than patients who received sevoflurane.

The current findings are consistent with previously published comparative studies by Nathanson et al which suggested that early recovery was faster with desflurane than sevoflurane.[9]

Findings of the present study are further supported by White PF et al who found that desflurane was associated with faster initial recovery but no significant difference was found between the two volatile agents in the later recovery period.[10] The duration of surgery and duration of anaesthesia for the two groups in our study was as follows. The mean value of duration of anaesthesia for desflurane and sevoflurane was 147.5 mins and 146.33 mins respectively which was not statistically significant (p= 0.71) and the mean duration of surgery for desflurane and sevoflurane is 126.5 mins and 114.33 mins respectively which was not statistically significant (p = 0.15). Also the study conducted by Eger EL 2nd et al[11] suggested that irrespective of the duration, recovery is quicker for the inhaled anaesthetic desflurane than for sevoflurane. Juvin P et al[12] further found that, immediate recovery occurs in significantly shorter time after a prolonged anaesthesia [199+/-57 mins with desflurane.

Our study shows the mean time to eye opening for the Desflurane (5.25 mins) and sevoflurane (7.57 mins) groups. The time to eye opening was significantly better with Desflurane compared to sevoflurane (p= <0.05).

J. E. Heavner et al[13] found the times to eye opening 5 (3–5); 11 (8–16) min for desflurane and sevoflurane respectively which shows desflurane was associated with earlier eye opening compared to sevoflurane.

Also, the study conducted by Ravi Jindal et al[14] demonstrated shorter times to eye opening with desflurane compared to patients receiving sevoflurane thus supporting that desflurane is associated with early emergence compared to sevoflurane.

The mean time to extubation in our study was, Desflurane (6.98 mins) and sevoflurane (10.07 mins). The time to extubation was significantly better with Desflurane compared to sevoflurane (p= < 0.05). This is further evidenced in the study conducted by Chen G, et al[15], who concluded that desflurane anaesthesia was associated with shorter times to Extubation compared to sevoflurane anaesthesia.

Finally, the mean time to orientation for the Desflurane (9.37mins) and sevoflurane (13.47 mins) group was noted. The time to orientation was significantly better with Desflurane compared to sevoflurane (p= < 0.05).

J. E. Heavner, A. D. Kaye, B.-K. Lin and T. King,[13] found the times to, squeezing fingers on command (7 (4–9); 12 (8–17) min); and orientation (7 (5–9); 16 (10–21) min) were significantly less (P<0.05) for desflurane than for sevoflurane.

Also, as per the study conducted by Chen G, Zhou Y, Shi Q, Zhou H[15] The time taken to follow commands (mean difference [MD] -3.27; 95% confidence intervals [CI] -4.95, -1.59), and orientation (MD -4.31; 95%CI -4.99, -3.62), were significantly shorter in the desflurane group than in the sevoflurane group.

Thus our findings are consistent with previously published comparative studies demonstrating that desflurane anaesthesia is associated with faster cognitive recovery.

Our study also shows the HMSE scores for both groups at various time intervals have no significant statistical difference. p values at 1 hr., 3 hr. and 6 hr. were 0.82, 0.78, and 0.19 respectively. This is consistent with Chen X, et al[2], who found that there

were no significant differences between the Desflurane and the Sevoflurane groups when the MMSE scores were compared preoperatively, and postoperatively at 1, 3, 6, and 24 hrs, thus supporting the outcome that recovery of cognitive function was similar after desflurane and sevoflurane-based anaesthesia.[16]

There were no patients with HMSE score <25 at the end of 3 hours and 6 hours.

Similar findings were noted by Deepak TS et al[17] who found that hundred percent of patients from desflurane group and 97% from sevoflurane group demonstrated completely normal cognitive function at 6 h postoperatively ($p = 0.31$).

CONCLUSION

Thus in conclusion, Desflurane is associated with faster emergence from anaesthesia compared to Sevoflurane but the early cognitive recovery is similar in both groups with no difference in the incidence of post-operative side effects like nausea, headache and dizziness.

Patients who received desflurane had a shorter extubation and recovery time. High cost of the anaesthetic is compensated by quality and controllability of anaesthesia and reduction of stay in recovery unit. In addition, the use of desflurane leads to early and predictable extubation, and helps in early transfer of patients from the operating theatre to the recovery area, which has a positive impact on patient turnover.

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