Garima Khera et al. / Vol 6 / Issue 1 / 2016 / 54-57.

International Journal of

Innovative Drug Discovery

e ISSN 2249 - 7609
Print ISSN 2249 - 7617

www.ijidd.com

FASTER RECOVERY IN NEUROSURGERY PATIENTS - ISOFLURANE OR SEVOFLURANE?

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ABSTRACT

Neuroanaesthesia continues to develop and expand. It is a specialty where the knowledge and expertise of the anesthetist may directly influence patient outcome. Evolution of neurosurgical practice is accompanied by new challenges for the anesthetist with greater focus on functional and minimally invasive procedures. The emphasis remains on the provision of good operative conditions, assessment and preservation of neurological function, and a rapid high quality recovery. In our study, 60 ASA I, II, III patients undergoing neurosurgery, were randomly divided into two groups to receive isoflurane and sevoflurane as maintenance along with O_2/N_2O mixture. Maintenance and recovery characteristics of both groups were noted and compared. Brain relaxation score was found lesser in sevoflurane than isoflurane (relaxed brain found in 43.3% patients vs. 10% respectively). The mean time for Squeezing Hand and moving feet is significantly lesser in sevoflurane group than isoflurane group (20% vs. 30% respectively). The mean time for Orientation (Name and location) is significantly lesser in sevoflurane than isoflurane group (30% vs. 60% respectively). Thus, we conclude, sevoflurane provides faster recovery in comparison to isoflurane in neurosurgery patients.

KEY WORDS: Isoflurane, Sevoflurane, ASA- American Society Of Anaesthesiology.

INTRODUCTION

Sevoflurane is a relatively new fluorinated ether inhalational agent, which is characterized by a low blood/gas partition coefficient. This confers titratability making sevoflurane a potentially useful drug in the neurosurgical setting [1]. In human studies sevoflurane has compared favorably to isoflurane, currently considered the most stable inhalational agent for neuroanaesthesia. Sevoflurane's insolubility confers rapid onset, intraoperative titratability and rapid offset, which should facilitate early postoperative evaluation in the neurosurgical setting.

Sevoflurane compares favorably to isoflurane as an inhalational induction agent but causes less disturbance of cerebral hemodynamics and less cerebral vasodilatation, it is the preferred agent for inhalational induction in the neurosurgical setting [2]. Early emergence is often an important goal in neuroanaesthesia. When compared with isoflurane, studies of non neurosurgical ASA I-III patients receiving sevoflurane have shown more rapid emergence, as assessed by eye opening, obeying commands, time to extubation and correctly stating name and date of birth [3-5].

EXPERIMENTAL

After approval by the hospital ethics committee, a bilingual written informed consent was obtained from all the participating patients. Sixty patients, ASA physical status I, II and III, of age group 18-70 years, were randomly divided into two groups to receive Sevoflurane or Isoflurane as maintenance anesthetic. A written informed consent was taken from each of the patients. Detailed history was taken and thorough physical examination was done. Patients having a GCS score <8 were excluded from this study. Patients received their usual medication on the day of the surgery. On arriving to OT, patients received Inj. Midazolam 0.03mg/kg IV and Inj. Fentanyl 1-2 microgram/kg, 3mins later the mean arterial pressure (MAP) and heart rate was noted. Induction consisted of IV Inj. Thiopentone 5-7 mg/kg in titrated doses. Endotracheal intubation was facilitated by Inj. vecuronium 0.1mg/kg IV.

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Maintenance of anesthesia was provided depending on the study group, with SEVOFLURANE (1-3% end tidal concentration) or ISOFLURANE (0.2-1.0% end tidal concentration) in combination with nitrous oxide (N2O) 50% in oxygen (O2) 50%. Minimum alveolar concentration (MAC) titrated according to surgical stimulation to maintain the MAP within 20% of the baseline value.

Episodes of hypotension (MAP decrease of more than 20% of baseline value) treated by decreasing the anesthetic concentration to 0.5 MAC and then with ephedrine 5mg/kg.

At dural opening brain relaxation was assessed by the attending neurosurgeon, who was blinded to the study group, by a four-point scale-

- Relaxed brain
- Mild brain swelling; acceptable
- Moderate swelling; no treatment required
- Severe swelling; treatment required.

Recover was noted on intervals between skin suturing to stopping inhalational agent, stopping inhalational agent to extubation and extubation to reappearance of cognitive functions. Continuous variables (e.g., demographic data, duration of anesthesia, and anesthetic requirements) were analyzed using an analysis of variance test with Bonferroni correction for post hoc comparisons. Nonparametric data was analyzed using Chi-square test or Kruskal-Wallis test, as appropriate. A p-value less than 0.05 was considered significant.

RESULTS

The study included 60 patients of American Society of Anaesthesiologists (ASA) grade I-III with the age group between 18-70 years and of both sexes and randomly divided into two equal groups. Group 1 received isoflurane while group 2 received sevoflurane as the inhalational agent.

Table 1. The comparison of Brain Relaxation Score across two study groups

Brain Relaxation Score	Sevoflurane Group (n=30)	Isoflurane Group (n=30)	P-value (Sevoflurane v/s Isoflurane)
Score 1 (Relaxed Brain)	13 (43.3)	3 (10.0)	0.024*
Score 2 (Acceptable)	12 (40.0)	16 (53.3)	
Score 3 (No Treatment Required)	4 (13.3)	7 (23.3)	
Score 4 (Treatment Required)	1 (3.3)	4 (13.3)	

Table 2. The comparison of recovery time till Extubation across two study groups

Recovery Time (Mins.)	Sevoflurane Group (n=30)	Isoflurane Group (n=30)	P-value (Sevoflurane v/s Isoflurane)
Tapering of Inhalation Agent	14.7 ± 5.3	25.5 ± 9.9	0.001***
Emergence	10.8 ± 5.2	19.1 ± 4.3	0.001***
Extubation	8.7 ± 5.1	18.5 ± 4.8	0.001***

Table 3. The comparison of recovery time till recovery of cognitive function across two study groups.

Recovery Time (Mins.)	Sevoflurane Group (n=30)	Isoflurane Group (n=30)	P-value (Sevoflurane v/s Isoflurane)
Squeeze Hand	6.2 ± 2.8	9.0 ± 3.7	0.001***
Move Feet	6.6 ± 2.8	10.9 ± 4.4	0.001***
Orientation (Name)	7.3 ± 3.4	19.1 ± 7.4	0.001***
Orientation (Location)	9.5 ± 5.4	23.0 ± 8.1	0.001***

Figure 1. Comparison of Brain Relaxation score

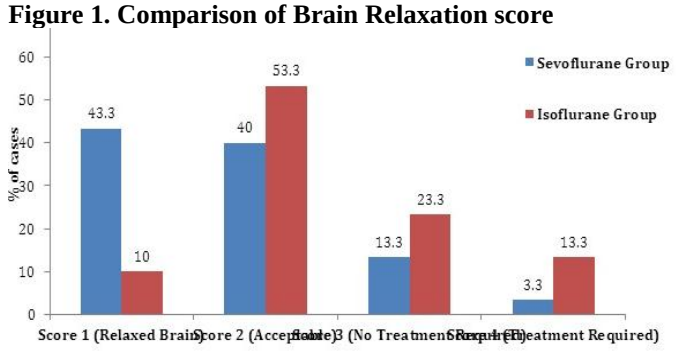


Figure 2. Comparison of Recovery Time Till Extubation

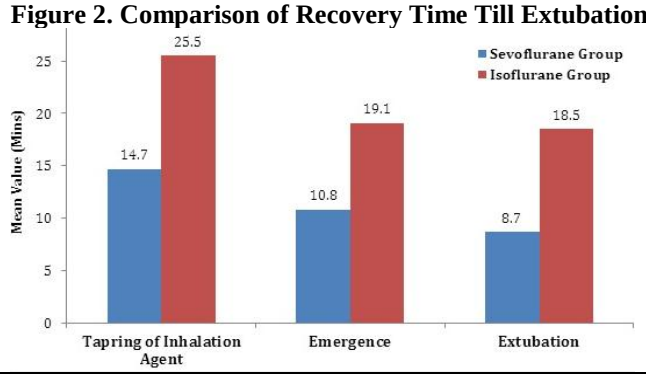
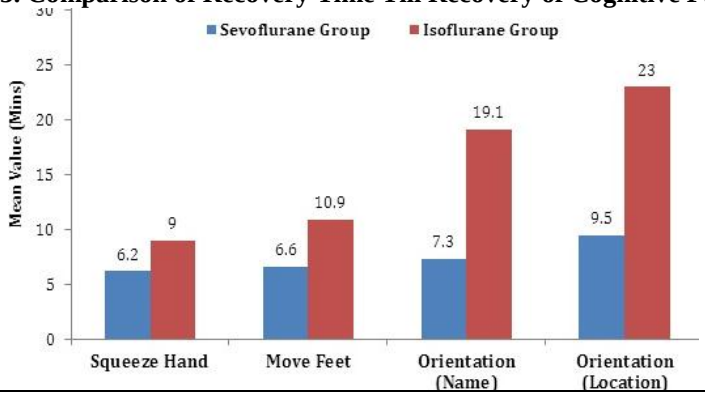


Figure 3. Comparison of Recovery Time Till Recovery of Cognitive Function



DISCUSSION

The volatile anesthetic sevoflurane has a favorable recovery profile because of its low blood/gas partition coefficient. The advantage of rapid awakening over more soluble anesthetics, such as isoflurane is magnified in surgical cases of 3 to 5 hour duration. Neurosurgeries usually last this long and the short period of recovery attribute to the poorly soluble anesthetics are critical to obtain an early neurological assessment of the patient in the postoperative period [6].

The purpose of this study was to study the existing knowledge of the comparative study of the volatile anesthetic agents: isoflurane and sevoflurane during neurosurgical procedure. The aim was to investigate the neuro protective mechanism in the form of brain relaxation score as well as the emergence and early and intermediate recovery [7].

Ayman A Ghoneim et al found that the mean emergence time, extubation time were significantly shorter in sevoflurane group than the isoflurane group. The neurosurgeon who was blinded to the group of study reported moderate brain swelling (grade 3) in 2 patients (10%) in the isoflurane group and 3 (15%) in the sevoflurane group.

In our study we derived that 23.3% patients in the isoflurane group had moderate brain swelling (grade 3) while in the sevoflurane group the same was seen in 13.3% patients.

Ayman G A et al [8] also found a significant decrease in MAP after induction of anesthesia than the pre induction levels and this decrease maintained throughout the study and returned non significant at the end of anesthesia. However, no statistically significant difference between the groups was detected.

Gupta and coworkers [9], in a systematic review, reported statistically significant differences between sevoflurane and isoflurane regarding the "time to opening eyes" and "time to obeying commands". The weighted mean difference in recovery between anesthetics was small and in favor of sevoflurane. In their study, Alain Gauthier et al [6] found that the emergence times were shorter for the patients receiving sevoflurane than for those receiving isoflurane. The median emergence time was 18 min for isoflurane and 14 min for sevoflurane. In our study it was found that the median emergence was 19 min for isoflurane and 11 min for sevoflurane.

Alain Gauthier et al [6] also found that seventy five percent of isoflurane patients opened their eyes within 28min and within 18 min for sevoflurane group. Seventy five percent of isoflurane group would squeeze a hand on command within 22 min and move their feet on command within 24 min. there was a strong co relation between "physical" recovery variables and "intellectual" variables

In our study it was found that the time taken for the patients of the isoflurane group to open their eyes was 19 min while that taken by the sevoflurane group was 11 min. The patients in the isoflurane group took 9 min to squeeze a hand on command and 11 min to move their feet on command. However the patients of the sevoflurane group took 6 min to squeeze hand on command and 7 min to move feet on command. Hence proving the mean time to squeeze hand significantly higher in the isoflurane group that the sevoflurane group. (p value <0.001). Also, the mean time taken to move feet on command in the isoflurane group is significantly higher in the isoflurane group in comparison to the sevoflurane group, (p value<0.001).

Anil Gupta et al [9] found a statistical difference in the "time to open eyes," "time to obeying commands," "home discharge". Early and intermediate recovery between sevoflurane and isoflurane were small and in favor of sevoflurane. Drowsiness was significantly more frequent with isoflurane compared with isoflurane in the postoperative period but no other significant difference was found in the incidence of postoperative complications.

In their study Agoliati et al [10] found that sevoflurane reduced the mean extubation time by 13% and reduced the SD by 8.7% relative to isoflurane. These reductions would reduce the incidence of prolonged extubation time by 51% and 35% respectively.

Reductions in time to following commands were substantially larger for extubation times and were sensitive

to outliers. In our study we have seen that the mean time for extubation is higher in isoflurane group, 18.5 min in comparison to sevoflurane, which has a mean time of 8.7 min. Similar study was done by Singh D et al [11] on 80 patients, in which they found that extubation and emergence times were significantly shorter with sevoflurane ($p<0.001$) hence proving that sevoflurane resulted in an early recovery when compared to isoflurane. The high correlation coefficients we obtained between the recovery variables indicate that these variables are in fact describing the same phenomenon, which is patient awakening. It also reflects the quality of recovery data obtained in this study. Thus this study shows that the low solubility anesthetic sevoflurane provides faster recovery than isoflurane for patients undergoing long duration neurological surgery. Sevoflurane also allowed for a faster basic neurological examination than isoflurane

ACKNOWLEDGEMENT: None

CONFLICT OF INTEREST

No conflict of interest between the Author and Co-author.

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