European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 9, Issue 6, 2022

ORIGINAL RESEARCH

To compare the intraoperative haemodynamic parameters and cost effectiveness between sevoflurane (inhalational) anaesthesia and propofol (tiva) based anaesthesia

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ABSTRACT

Aim: To compare the intraoperative haemodynamic parameters and cost effectiveness between sevoflurane (inhalational) anaesthesia and propofol (tiva) based anaesthesia
Methods: Following informed consent, hundred ASA I and II patients aged 19-63 years of either sex having general anaesthesia were randomly split into two groups of 50. Patients with an ASA of III or higher, major cardiovascular, renal, or pulmonary disease, a history of malignant hyperthermia, any documented allergy to the study agent, H/O any mental condition, or use of sedative medicines were excluded from the study. Sevoflurane was used in Group A, while Propofol was used in Group B.
Results: The Sevoflurane group (51.02±4.52) had a quicker induction time (sec) than the Propofol group (61.29±5.51), which was statistically significant (p<0.001). The recovery profile after the agents were withdrawn at the conclusion of surgery revealed a significant difference in spontaneous eye opening (9.5±1.3 min in Sevoflurane group and 13.4±1.4 min in Propofol group), verbal communication (11.5±1.9 min in Sevoflurane group and 14.6±1.9 min in Propofol group) and mental orientation (16.1±1.6 min Sevoflurane group and 20.3±2.1min Propofol group) (p<0.001), with Sevoflurane demonstrating the superior recovery profile.
Conclusion: In terms of quicker induction and rapid recovery characteristics, we discovered that Sevoflurane outperforms Propofol. The intraoperative hemodynamics of the two groups were equivalent, with no statistically significant difference. However, Sevoflurane-based anaesthesia is still more expensive than Propofol, which if addressed would serve as a good choice of anaesthesia in impoverished nations.
Keywords: General Anesthesia, sevoflurane, propofol, TIVA, haemodynamic stability.

INTRODUCTION

Although inhalational anaesthesia is the most commonly used kind of anaesthesia globally, anaesthetic gases have been recognised as powerful greenhouse gases[1], which, when excreted unmetabolized, pollute air and increase the greenhouse effect. The typical composition of waste gases is predicted to be:[2] oxygen 25%-30%, nitrogen 60%-65%, nitrous oxide 5%-10%, and volatile halogenated anaesthetic gases 0.15%-0.5%. Blue-zone technologies and scavenging, low-flow, and minimal-flow anaesthesia [2] are the most recent methods for

reducing the quantity of gas discharged into the environment, although total intravenous anaesthesia (TIVA) is the only known method for fully avoiding the use of anaesthetic gases and consequently air pollution. TIVA is a general anaesthetic treatment that employs a mix of drugs administered only intravenously. Because of the pharmacokinetic and pharmacological features of medications like propofol and short-acting opioids like remifentanil, as well as the emergence of target-controlled infusion (TCI) pumps, TIVA has grown more popular, feasible, and practicable in recent years. [3] Furthermore, as compared to standard inhalational anaesthesia, TIVA provides better postoperative recovery and hemodynamic stability, a lower incidence of postoperative nausea and vomiting, and a lower recurrence rate in breast cancer.[4] However, despite the availability of thorough research and recognised benefits, there is still concern about the depth of anaesthetic and intraoperative awareness with TIVA. Wong et al[5] conducted a survey to identify the variables impacting the usage of TIVA, such as the unavailability of TCI pumps (cost may be the cause), extra costs raising the cost, difficult to forecast wake-up, and greater awareness. Taking these considerations into account, the current study aimed to compare TIVA with conventional inhalational mode in patients undergoing modified radical mastoidectomy (MRM) in terms of maintaining adequate depth of anaesthesia as measured by bispectral index (BIS), recovery profile, and cost analysis.

METHODS AND MATERIALS

This Study was conducted in M.L.B Medical College, Jhansi between January 2017 to December 2017. Following informed agreement, hundred ASA I and II patients aged 19-63 years of either sex having general anaesthesia were randomly split into two groups of 50. Patients with an ASA of III or higher, major cardiovascular, renal, or pulmonary disease, a history of malignant hyperthermia, any documented allergy to the study agent, H/O any mental condition, or use of sedative medicines were excluded. Sevoflurane was used in Group A, while Propofol was used in Group B.

METHODOLOGY

All patients were fasted overnight and premedicated in the pre-operative room with Inj. Ranitidine 50 mg i.v. The i.v line was secured upon arrival in the operating room, and baseline data such as HR, NIBP, and SpO2 were recorded. All patients received a 1 mcg/kg injection of fentanyl. Patients in group A were induced using the vital capacity rapid inhalational induction (VCRII) approach, which used 8 percent Sevoflurane with N2O in O2 (3L each) from a closed circuit that was primed for 1 minute. Prior to the induction, patients were instructed to do vital capacity breathing. The induction time was recorded, which is the period between the initiation of anaesthesia and the loss of the eyelid reflex. Inj. Rocuronium 0.6 mg/kg was administered as a loading dose and then 1/3 as a maintenance dosage to all patients in both groups for muscular relaxation. In group B, patients were induced with Inj. Propofol 2-2.5 mg/kg until the eyelid reflex was lost. Intraoperatively, Inj. Propofol infusion was administeredat 8mg/kg/hr for the first ten minutes, 6mg/kg/hr for the following ten minutes, and 3mg/kg/hr until the completion of operation. Inj. Fentanyl was also given as an infusion of 1 mcg/kg/hr till the completion of the procedure. For PONV, all patients received an injection of Ondensetron 0.1 mg/kg. When the skin sutures were being administered, both the Sevoflurane and Propofol infusions were halted. The reversal consisted of injections of neostigmine (50 mcg/kg) and glycopyrolate (10 mcg/kg), and patients were extubated after adequate suctioning and the resumption of spontaneous breathing.

RESULTS

There was no statistically significant difference between the two groups in terms of age, weight, gender, ASA, or length of operation. The Sevoflurane group (51.02±4.52) had a

quicker induction time (sec) than the Propofol group (61.29±5.51), which was statistically significant (p<0.001). Furthermore, the intraoperative haemodynamic parameters (heart rate and blood pressure) were similar across the two groups, with no statistically significant difference.

Table 1 Gender and Age distribution of patients

	Group A	Group B
Gender		
Male	36	35
Female	14	15
Age	44.25±96	43.67±41

Table 2 induction time (seconds)

	Group A	Group B	P-value
Induction time (Seconds)	51.02±4.52	61.29±5.51	0.0001

Table 3 comparison based on MAP (mmHg) among two groups at different time intervals

Time Interval	Group A	Group B	P-value
Baseline	101.1±5.29	103.1±6.22	0.33
Before Induction	99.1±5.77	98.1±7.15	0.41
After Induction	90.6±6.36	89±6.74	0.29
1 min after intubation	92.3±4.74	90.3±5.87	0.44
3 min after intubation	94.2±5.11	92.3±5.69	0.77
5 min after intubation	97.1±5.37	95.1±6.71	0.54
10 min after intubation	99.2±4.89	98.4±5.12	0.37
15 min after intubation	101±6.01	98.7±4.98	0.11
25 min after intubation	99.1±6.11	97.3±4.88	0.29
35 min after intubation	100.2±5.74	98.2±5.69	0.19
45 min after intubation	101.4±4.97	100.1±6.37	0.21
55 min after intubation	101.9±5.22	100.5±6.12	0.29
65 min after intubation	102.4±5.67	101.2±5.22	0.63
75 min after intubation	103.1±4.99	103.1±5.76	0.41

The recovery profile after the agents were withdrawn at the conclusion of surgery revealed a significant difference in spontaneous eye opening (9.5±1.3 min in Sevoflurane group and 13.4±1.4 min in Propofol group), verbal communication (11.5±1.9 min in Sevoflurane group and 14.6±1.9 min in Propofol group) and mental orientation (16.1±1.6 min Sevoflurane group and 20.3±2.1min Propofol group) (p<0.001), with Sevoflurane demonstrating the superior recovery profile.

Table 4: recovery profile

	Group A	Group B	P-value
Time till spontaneous eye opening (Minutes)	9.5±1.3	13.4±1.4	0.001
Time to verbal communication (Minutes)	11.5±1.9	14.6±1.9	0.001
Time to mental orientation (Minutes)	16.1±1.6	20.3±2.1	0.001

The entire amount of Propofol used for induction and maintenance was recorded. The Dion formula was used to determine the quantity of Sevoflurane consumed. PTFM/2,412 d (P= Vaporizer dial conc, F= Fresh gas flow l/m, T= duration for which the conc was set in minutes, M= Mol. Mass of Sevoflurane, D= Density of liquid Sevoflurane in millilitres) The

equation might be rewritten as Amount of Sevoflurane utilised = 0.00557 X Sevoflurane conc. X Time after the fixed variables were substituted (sec). The total quantity of Sevoflurane ingested was estimated by summing the amounts needed for priming, induction, and anaesthesia maintenance. The overall amount of each agent utilised was similar (43 mL in Sevoflurane gp and 41 mL in Propofol gp), although Sevoflurane is still more expensive than Propofol. The real cost of a 50 ml vial of Sevoflurane was roughly 750 rupees, whereas the same amount of Propofol was around 500 rupees.

DISCUSSION

Modern medical research needs high-quality anaesthetic with few side effects and a quick recovery. The optimal anaesthesia approach has the following characteristics: quick and speedy induction, physiologically stable maintenance with conveniently adjustable anaesthetic depth, and rapid and full recovery permitting early return to regular activities. In general, both Propofol and Sevoflurane satisfy these requirements. Propofol is a popular intravenous drug that is used as a key component of TIVA. Because of its low blood gas solubility and non-irritant properties, sevoflurane at high concentrations is useful for induction and maintenance of anaesthesia. We found no statistically significant differences between the two groups in terms of age, weight, gender, ASA, or length of operation. In our investigation, the mean time for induction in the Sevoflurane group was 51.02±4.52 seconds, while it was 61.29±5.51 seconds in the Propofol group ($p<0.001$). The vital capacity breath approach with 8% Sevoflurane has been shown to result in quicker induction than the usual incremental dosage strategy. Lim KY et al[6] discovered that the Sevoflurane VCRII approach had a shorter induction time than the i.v Propofol induction. EL - Radiadeh and El - Ghazo[7] also observed that the Sevoflurane vital capacity breath method caused a quicker loss of consciousness than Propofol. Sevoflurane possesses properties that allow for quick, smooth inhalational induction, such as low blood gas solubility, a lack of pungency, and a vaporizer with high overpressure capacity. Sevoflurane's vital capacity breath offers quick induction, particularly when combined with N2O 50% in oxygen. Furthermore, this strategy has been shown to improve patient acceptance. When comparing the vital capacity induction approach with the tidal breathing technique, the VCRII technique demonstrated higher patient acceptance and a shorter induction period.

Our findings were similarly consistent with those of Hall JE et al[8], who compared Sevoflurane inhalational induction with an intravenous bolus of Propofol. They discovered that 8 percent Sevoflurane in N2O and O2 is a quick, dependable, and safe approach for inducing anaesthesia and a viable alternative to i.v Propofol. In terms of haemodynamic stability, PONV and post-operative sedation ratings, and orientation to locations. Konstantopoulos K, Markis A, Moustaka A, et al[9] discovered that the induction and maintenance properties of Sevoflurane and Propofol-based anaesthesia were equivalent. Our findings on intraoperative hemodynamics revealed no significant differences between the two groups. During anaesthesia induction, both heart rate and MAP were reduced in a similar manner. Bharti N et al[10] discovered that intraoperative hemodynamics during induction and maintenance were equivalent in both groups. Our findings were also consistent with those of Amingad B and Prashanth Gowtham Raj SK[11]. The patient's orientation in time and space offers an approximate estimate of cognitive function recovery. In our study, the recovery profile revealed a statistically significant difference between the two groups, with the Sevoflurane group having quicker recovery. Our findings were consistent with those of Orhon ZM et al[12] and Kumar A et al[13], who discovered that recovery time following Sevoflurane anaesthesia was lower than that of Propofol-based anaesthesia. The emergence and post-operative recovery profiles of Sevoflurane and Propofol were compared by Shah A and Adoraja RN.[14] Sevoflurane was discovered to have a superior recovery profile than

intravenous Propofol. The quick recovery with Sevoflurane has been linked to its insoluble character, rapid wash in and out, and low blood:gas partition coefficient. Another study[15] by Cattano D et al[15] compared complete intravenous anaesthesia with Propofol to inhalational anaesthetic with Sevoflurane for post-operative symptoms such as pain, nausea and vomiting, and recovery time. They discovered no statistically significant difference between the two drugs in terms of the aforementioned effects. In our investigation, we discovered no significant difference in the total amount of each agent utilised between the two groups. However, in terms of cost, we discovered that Sevoflurane-based anaesthesia is still more expensive than Propofol-based anaesthesia. Tang Jun et al.[16] found that the overall cost of Sevoflurane anaesthesia was higher than that of Propofol anaesthesia.Contrarily, Smith I et al[17] discovered that complete intravenous anaesthesia with Propofol was more costly than the use of Sevoflurane for anaesthesia induction and maintenance. Maratha V et al[18] observed that Sevoflurane-based anaesthesia was more cost effective than our findings. The explanation might be the quantity of waste created by the unneeded medication.

CONCLUSION

In terms of quicker induction and rapid recovery characteristics, we discovered that Sevoflurane outperforms Propofol. The intraoperative hemodynamics of the two groups were equivalent, with no statistically significant difference. However, Sevoflurane-based anaesthesia is still more expensive than Propofol, which if addressed would serve as a good choice of anaesthesia in impoverished nations.

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