

Comparison of Hemodynamic Effect of Sevoflurane 1.5% and Desflurane 3% in Laproscopic Appendicectomy

Dushyant Chavda¹, Shaikh Abdul Nasir², Anjali Kankhara³

How to cite this article:

Dushyant Chavda, Shaikh Abdul Nasir, Anjali Kankhara/Comparison of Hemodynamic Effect of Sevoflurane 1.5% and Desflurane 3% in Laproscopic Appendicectomy/Indian J Anesth Analg. 2022;9(6):267-274.

Abstract

Aims and objective: To compare hemodynamic parameters, complication, recovery time and time of early extubation with sevoflurane and desflurane.

Materials and methods: This was prospective study conducted from January to December 2020 using sampling technique total 60 adult patient of American society of Anesthesiologist (ASA) Grade I, II, III. Age between 18–60 years of either male or female who were posted for Laproscopic appendicectomy under general anesthesia were selected for study after informed consent. All the patient were randomly allocated into one of two group using computer generated random number table. Group 'S' received induction with sevoflurane and Group 'D' received induction with desflurane.

Result: Both group were not differ significantly in age, weight, sex, ASA grade. Heart rate was significantly higher in sevoflurane group than desflurane group after intubation. Systolic blood pressure was significantly higher in sevoflurane group. Sevoflurane group showed higher time in spontaneous respiration, verbal commands following, ET removal time.

Conclusion: Desflurane provides faster recovery from anesthesia and better hemodynamic stability intraoperative and post operative.

Keywords: Desflurane, Sevoflurane, Hemodynamic.

Author's Affiliation: ¹Senior Resident, Department of Anesthesia, Dhiraj Hospital, Sumandip Vidyapith, Baroda 391760, India, ²Associate Professor, Department of Anesthesia, Pandit Deendayal Upadhyay Medical College & Govt. Hospital, Rajkot 360001, Gujarat, India, ³Assistant Professor, Department of Anesthesia, G.G. Hospital, Jamnagar, M.P Shah Medical College, Jamnagar 361008, Gujarat, India.

Corresponding Author: Dushyant Chavda, Senior Resident, Department of Anesthesia, Dhiraj Hospital, Sumandip Vidyapith, Baroda 391760, India.

E-mail: dushyantc20@gmail.com

Received on: 12.09.2022

Accepted on: 14.10.2022

INTRODUCTION

Sevoflurane, a volatile anesthetic agent, is a halogenated methyl propyl ether. It is non-irritant, non-inflammable and produces bronchodilatation. Due to low blood/gas partition coefficient, it has rapid induction. It can be used for inhalational induction^{1,2} and develop dose-dependent cardiovascular and respiratory depression. Sevoflurane does not activate the sympathetic nervous system.³ Desflurane is a

fluorinated methyl ethyl ether and has a pungent odour, irritable to the respiratory tract and non-inflammable. Low solubility of desflurane in blood and body tissues leads to rapid induction and recovery. It does not predispose to ventricular arrhythmias. Monitoring of hemodynamic characteristics includes electrocardiogram (ECG), oxygen saturation, non-invasive mean arterial pressure, heart rate (HR) and end tidal CO₂ (EtCO₂). Early recovery facilitated by rapid and short acting drugs for induction and maintenance of anesthesia and following day care surgery. Hence, this study was carried out with the objective to compare the hemodynamic parameters and recovery characteristics of desflurane with sevoflurane.

MATERIALS AND METHODS

Study Setting and Duration

This study was conducted in the Department of Anesthesiology within the premises of tertiary care hospital of Jamnagar.

Study Design and Study Population

This was a prospective study designed to compare the hemodynamic and recovery profile of patients administered with desflurane vis-à-vis sevoflurane for general anesthesia. Using convenient sampling technique, a total of 60 adult patients of the American Society of Anesthesiologists (ASA) physical status Grade I, II and III aged between 18 and 60 years, of either sex, who were scheduled for laproscopic appendectomy under general anesthesia were selected for the study after informed consent. Patients who did not provide consent to be included in the study or patients with correlated cardiovascular, pulmonary, renal disease or history of hypersensitivity to halogenated anesthetic agents were excluded from the study. All the patients were randomly allocated into one of the two groups using computer generated random number table. Hence, each group contained a total of thirty patients.

Anesthesia Technique: Induction, Maintenance and Recovery

Pre-anesthetic check-up was performed the day before and on the day of surgery. Basic routine investigations such as hemoglobin, renal function tests, serum electrolytes, random blood sugar and chest X-ray posteroanterior view were done and recorded. In the operating room, all standard monitors such as non-invasive blood

pressure (NIBP), pulse oximetry (SpO₂), ECG and capnography (EtCO₂) were attached and vital parameters of the patient recorded. All the patients in both groups were pre-medicated with injection ondansetron 80mcg/kg and injection glycopyrrolate 4 mcg/kg intravenous (IV). In both groups, after pre-oxygenation with 100% O₂ for 3 min, anesthesia was induced using injection propofol 2 mg/kg IV. This was followed by endotracheal intubation facilitated using injection succinylcholine 2 mg/kg IV.

Intubation was confirmed with EtCO₂ and injection atracurium 0.5 mg/kg IV was given after return of respiration analgesia given with Inj. paracetamol 15 mg/kg and Inj. Dexmedetomidine 0.5 mcg/kg In Group S, anesthesia was maintained using sevoflurane (1.5%), nitrous oxide (50%) and oxygen (50%) with intermittent injection of atracurium. In Group D, anesthesia was maintained with desflurane (3%), nitrous oxide (50%) and oxygen (50%) with injection of atracurium intermittently.

Administration of volatile anesthetic agents and oxygen was discontinued at the end of surgery after the onset of spontaneous respiration. Neuromuscular blockade was reversed with injection neostigmine 50 mcg/kg iv and injection glycopyrrolate 8 mcg/kg IV. Extubating of trachea was done when patients were adequately recovered from the effects of neuromuscular blockade with regular breathing pattern and were able to respond to verbal commands. Time of extubation and the times at which patients were able to state their name were recorded.

STATISTICAL ANALYSIS

Qualitative data will be expressed as percentages and proportions.

Quantitative data will be expressed as mean and standard deviation. The differences between two groups with respect to continuous variables will be analysed using unpaired t-test, while categorical variables will be analysed using Chi-square test. $P < 0.05$ will be considered statistically significant, while $P < 0.01$ will be considered statistically highly significant.

Ethical Consent

Before doing study ethical clearance was taken from the hospital ethics committee. Each patient was taken for study after informed consent.

RESULTS

Total 60 patient aged 18 to 60 years with ASA I, II, III included in this study. Table 1 shows that baseline

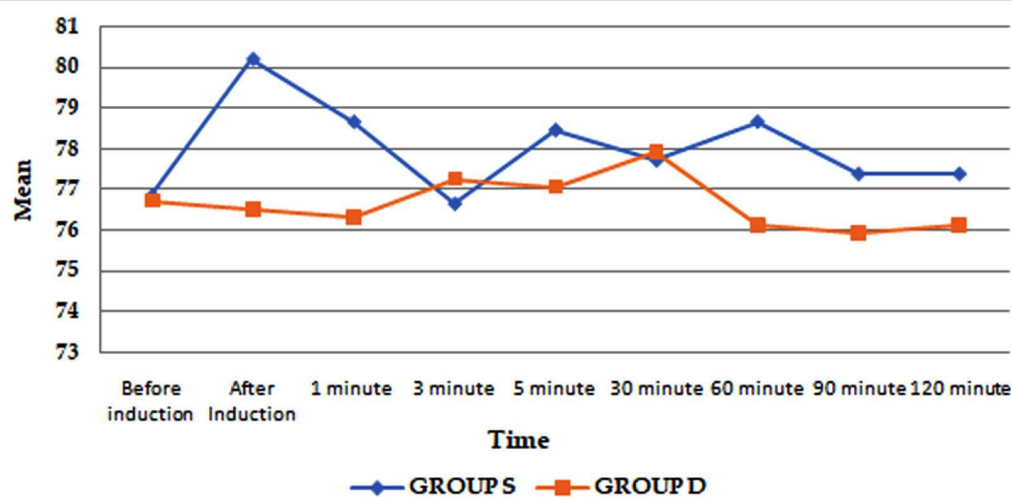
demographic analysis shows that two groups did not differ significantly in age, weight and sex. Both the group were comparable with respect to ASA grade and the difference was not significant.

Table 1: Baseline Characteristic of two Group.

Characteristic	Group S	Group D	P Value	Significance
Mean age $\pm$ SD	35.15 $\pm$ 15.04	34.17 $\pm$ 5.75	>0.05	NS
Mean weight $\pm$ SD	59.67 $\pm$ 6.3	59.17 $\pm$ 5.74	>0.05	NS
Male	16	18	>0.05	NS
Female	14	12	>0.05	NS
Grade I	5	4	>0.05	NS
GradeII	2	4	>0.05	NS
Grade III	23	22	>0.05	NS

Table 2: Mean Heart Rate (T Beats Per Minute) With Standard Deviation at Various Interval

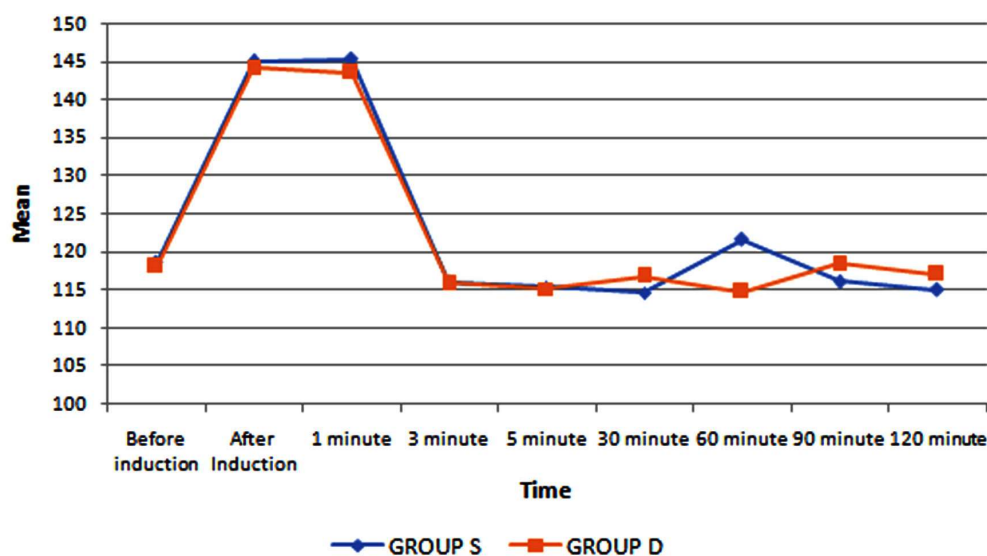
Time	Group S	Group D	P	Significance
Before induction	76.87 $\pm$ 5.60	76.73 $\pm$ 5.19	>0.05	NS
After Induction	80.20 $\pm$ 4.88	76.53 $\pm$ 5.70	<0.05	S
1 minute	78.67 $\pm$ 5.39	76.33 $\pm$ 5.20	>0.05	NS
3 minute	76.67 $\pm$ 5.49	77.27 $\pm$ 4.65	>0.05	NS
5 minute	78.47 $\pm$ 5.60	77.07 $\pm$ 3.92	>0.05	NS
30 minute	77.73 $\pm$ 5.32	77.93 $\pm$ 4.94	>0.05	NS
60 minute	78.67 $\pm$ 4.28	76.13 $\pm$ 2.78	>0.05	NS
90 minute	77.40 $\pm$ 5.28	75.93 $\pm$ 2.99	>0.05	NS
120 minute	77.40 $\pm$ 5.28	76.13 $\pm$ 2.73	>0.05	NS



In Table 2 Heart rate table shows that HR was statistically significantly higher in sevoflurane group than desflurane group at after intubation. There was no significant difference between before intubation and 1, 3, 5, 30, 60, 90, 120 minutes.

Table 3: Mean Systolic Blood Pressure at Various Intervals

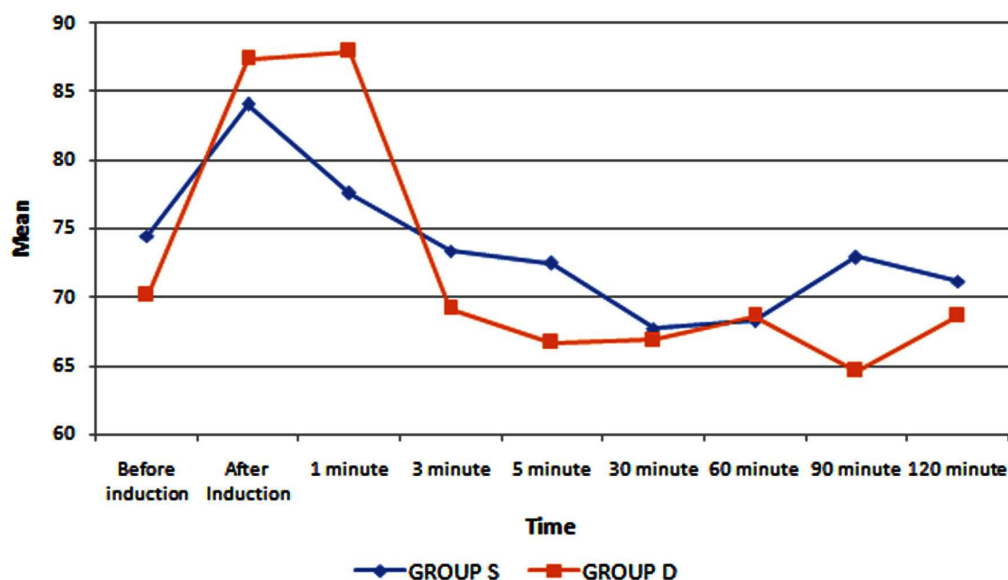
Time	Group S	Group D	P	Significance
Before induction	118.67±5.47	118.13±2.97	>0.05	NS
After induction	145.13±3.59	144.20±2.75	>0.05	NS
1 minute	145.33±3.73	143.67±3.37	>0.05	NS
3 minute	116.13±3.86	115.93±3.58	>0.05	NS
5 minute	115.47±4.17	115.20±3.18	>0.05	NS
30 minute	114.73±5.74	116.90±4.02	>0.05	NS
60 minute	121.67±4.49	114.80±2.66	<0.05	S
90 minute	116.20±2.59	118.47±4.32	<0.05	S
120 minute	115.07±3.81	117.13±3.85	<0.05	S



In table 3 Systolic blood pressure table shows systolic blood pressure was statistically significantly higher in Sevoflurane group than desflurane at 60,90,120 minute.

Table 4: Mean Diastolic Blood Pressure at Various Intervals

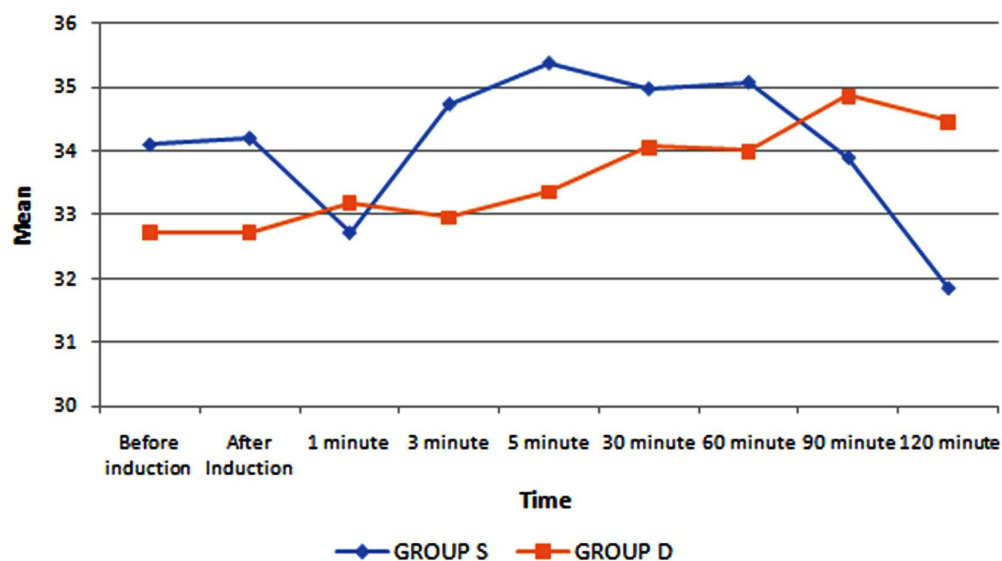
Time	Group S	Group D	P	Significance
Before induction	74.47±5.40	70.12±6.10	>0.05	NS
After induction	84.07±4.38	87.40±3.37	<0.05	S
1 min	77.60±5.44	87.93±3.73	<0.05	S
3 min	73.40±4.73	69.20±4.02	<0.05	S
5 min	72.47±4.69	66.67±3.03	<0.05	S
30 min	67.73±5.17	66.87±4.03	>0.05	NS
60 min	68.27±4.39	68.60±5.41	>0.05	NS
90 min	72.93±4.78	64.60±5.54	>0.05	NS
120 min	71.20±6.05	68.60±5.28	>0.05	NS



In table 4 Diastolic blood pressure table shows diastolic blood pressure of sevoflurane group has statistically Significantly higher at 3 and 5 min after intubation than desflurane group.

Table 5: Mean End Tidal CO₂ MmHg at Various Intervals

Time	Group S	Group D	P	Significance
Before induction	34.10±1.09	32.73±1.13	<0.05	S
After induction	34.20±1.19	32.73±1.14	<0.05	S
1 min	32.73±1.55	33.20±1.27	<0.05	S
3 min	34.73±1.08	32.97±1.00	<0.05	S
5 min	35.37±0.67	33.37±0.93	<0.05	S
30 min	34.97±0.71	34.07±1.53	>0.05	NS
60 min	35.07±0.83	34.00±1.31	<0.05	S
90 min	33.90±1.24	34.87±1.07	<0.05	S
120 min	31.87±1.01	34.47±1.04	<0.05	NS



In table 5 End tidal CO₂ table shows that ETCO₂ of sevoflurane group was statistically significantly Higher at before intubation, after intubation, 3, 5, 60 minutes.

Table 6: Recovery and Post Operative Complication in Both Groups

Profile	Group S	Group D	P value
Spontaneous respiration (min)	4.77± 0.97	3.47± 0.68	<0.05
Follow verbal commands (min)	6.10± 1.06	4.80 ± 0.75	<0.05
ET removal (min)	6.47 ± 0.51	6.20± 0.61	<0.05
Mucosal bleeding	9	5	-
Sore throat	20	25	-
Hoarseness of voice	5	10	-
Hypoxia	15	10	-
Change in pulse	14	6	-
Change in BP	10	3	-

Table 6 shows there was significantly delay in spontaneous respiration, verbal commands Following, ET removal time in sevoflurane group compared to desflurane group Post operative mucosal bleeding more in sevoflurane group. Post operative sore throat and hoarseness of voice more in desflurane group. Post operative hypoxia, change in blood pressure and heart rate more in Sevoflurane group.

DISCUSSION

Our study found there was no statistically significant difference between two group with respect to gender, age, body weight, ASA classification.

Time Taken for Spontaneous Breathing

In our study, time to spontaneous breathing from termination of anesthetic is significantly shorter with desflurane group when compared and sevoflurane groups ($p < 0.05$). In desflurane group it was 3.47 ± 0.68 minutes whereas it was 5.23 ± 0.90 in sevoflurane groups respectively.

Time Taken for following Verbal Commands

Time for eye opening in desflurane and sevoflurane groups was 4.80 ± 0.75 and 6.10 ± 1.06 minutes respectively. It is significantly shorter in desflurane group ($p < 0.05$).

Time taken for Extubation

In our study the desflurane group took significantly shorter time for extubation when compared with the sevoflurane group. The time was 6.20 ± 0.61 minutes in desflurane group and 7.27 ± 0.83 minutes in sevoflurane group. ($p < 0.05$)

*Gulcan Erk et al.*⁴ compared the effects of desflurane, sevoflurane and propofol on recovery characteristics and PONV in laparoscopic cholecystectomy. They found that extubation and eye opening times (early recovery) were meaningfully lower in desflurane group and no significant differences were observed in orientation, sitting and walking times (delayed recovery). In our study also the desflurane group had shorter early recovery times.

*Dajun Song et al.*⁵ found that compared with the propofol group, the times to awakening and to achieve a recovery score of 10 were significantly shorter, and the percentage of patients judged fast-track eligible on arrival in the PACU was significantly higher, in the desflurane and sevoflurane groups (90% and 75% vs 26%) after laparoscopic tubal ligation surgery. They concluded that compared with propofol, desflurane and sevoflurane resulted in a higher percentage of outpatients being judged eligible for fast tracking.

Intraoperative Hemodynamics

The present study found observe that desflurane has better stability then sevoflurane regarding hemodynamic parameters such as heart rate, blood pressure, end tidal carbon dioxide.

The present study observed that desflurane has better stability than sevoflurane regarding hemodynamics parameter such as HR, BP, and EtCO₂. This finding are similar with similar study done by *Fletcher et al.*⁷ *Shan et al.*⁸ *Magni et al.*⁹ and *Nathanson et al.*¹⁰ However similar studies done by *White et al.*¹¹ *Patel and Parmar*¹² *Gupta et al.*¹³ *Weiskopf et al.*¹⁴ *Kang et al.*¹⁵ *Kaur et al.*¹⁶ *Strum et al.*¹⁷ and *Gergin et al.*⁶ observed no difference between hemodynamic parameter such as HR, BP and EtCO₂.

Their result indicated that desflurane like isoflurane could maintain hemodynamic stability in concentration producing surgical anesthesia. In another study, finding showed that desflurane might be more successful in controlling hypertensive response than isoflurane.²¹

Post Operative Complications

In our study post operative sore throat and hoarseness of voice more with desflurane group, and mucosal bleeding, post operative hypoxia, post operative change in blood pressure, post operative change in heart rate changes more with sevoflurane group.

CONCLUSION

Our study concludes that desflurane provides faster recovery from anesthesia in patients undergoing laparoscopic appendectomy than sevoflurane. Our study also concludes that desflurane has better hemodynamic stability intraoperative and postoperative. Sore throat and hoarseness of voice more with desflurane.

Financial Support and Sponsorship: Nil

Conflicts of Interest: No conflicts of interest

REFERENCES

1. Eberts TJ, Schmid PG. Inhaled anesthetics. In: Barash PG, Cullen BF, Stoelting RK, Cahalan MK, Stock MC, editors. Clinical Anesthesia. 6th ed. Philadelphia, PA: Lippincott Williams and Wilkins; 2009. p. 413-43.
2. Morgan GE Jr., Mikhail MS, Murray MJ. Inhalational anesthetics. In: Clinical Anesthesiology. 4th ed. New York: McGraw-Hill; 2006. p. 155-78.
3. Ebert TJ, Muzi M, Lopatka CW. Neurocirculatory responses to sevoflurane in humans. A comparison to desflurane. Anesthesiology 1995;83:88-95.
4. Jeffrey L. Apfelbaum, MD, J. Lance Lichtor, MD, Bradford S. Lane, BA, Dennis W. Coalson, MD, and Kari T. Korttila, MD, PhD. Awakening, Clinical Recovery, and Psychomotor Effects After Desflurane and Propofol Anesthesia. Anesth Analg 1996; 83:721-725.
5. Anil Gupta, MD, FRCA, PhD, Tracey Stierer, MD, Rhonda Zuckerman, MD, Neal Sakima, MD, Stephen D. Parker, MD, and Lee A. Fleisher, MD. Comparison of Recovery Profile After Ambulatory Anesthesia with Propofol, Isoflurane, Sevoflurane and Desflurane: A Systematic Review. Anesth Analg 2004;98:632-41.
6. S. Gergin, B. Cevik, G. Yildirim, E. Ciplakligil & S. Colakoglu: Sevoflurane Vs Desflurane: Hemodynamic Parameters And Recovery Characteristics. The Internet Journal of Anesthesiology. 2005 Volume 9 Number 1.
7. Fletcher JE, Sebel PS, Murphy MR, Smith CA, Mick SA, Flister MP. Psychomotor performance after desflurane anesthesia: A comparison with isoflurane. Anesth Analg 1991;73:260-5.
8. Shan J, Sun L, Wang D, Li X. Comparison of the neuroprotective effects and recovery profiles of isoflurane, sevoflurane and desflurane as neurosurgical pre-conditioning on ischemia/reperfusion cerebral injury. Int J Clin Exp Pathol 2015;8:2001-9.
9. Magni G, Rosa IL, Melillo G, Savio A, Rosa G. A comparison between sevoflurane and desflurane anesthesia in patients undergoing craniotomy for supratentorial intracranial surgery. Anesth Analg 1995; 81:118-90.
10. Nathanson MH, Fredman B, Smith I, White PF. Sevoflurane versus desflurane for outpatient anesthesia: A comparison of maintenance and similar with the study done by Kaur et al., [18] Larsen et al. [28] and Loop and Priebe. [29] This finding is not comparable with recovery profiles. Anesth Analg 1995;81:1186-90.
11. White PF, Tang J, Wender RH, Yumul R, Stokes OJ, Sloninsky A, et al. Desflurane versus sevoflurane for maintenance of outpatient anesthesia: The effect on early versus late recovery and perioperative coughing. Anesth Analg 2009;109:387-93.
12. Patel M, Parmar N. Comparison of hemodynamic parameters and recovery characteristics between sevoflurane and desflurane in patients undergoing day care gynecological laparoscopic surgery. Int J Med Sci Public Health 2016;5:1412-6.
13. Gupta P, Rath GP, Prabhakar H, Bithal PK. Comparison between sevoflurane and desflurane on emergence and recovery characteristics of children undergoing surgery for spinal dysraphism. Indian J Anesth 2015;59:482-7.
14. Weiskopf RB, Moore MA, Eger EI 2nd, Noorani M, McKay L, Chortkoff B, et al. Rapid increase in desflurane concentration is associated with greater transient cardiovascular stimulation than with rapid increase in isoflurane concentration in humans. Anesthesiology 1994;80:1035-45.
15. Kang H, Cha SM, Park SG, Jung YH, Woo YC, Kim JY, et al. The effects of changing from isoflurane to desflurane on the recovery profile during the latter part of anesthesia. Acta Med Okayama 2010;64:307-16.
16. Kaur A, Jain AK, Sehgal R, Sood J. Hemodynamics and early recovery characteristics of desflurane versus sevoflurane in bariatric surgery. J Anesthesiol Clin Pharmacol 2013;29:36-40.

17. Strum EM, Szenohradzki J, Kaufman WA, Anthonie GJ, Manz IL, Lumb PD. Emergence and recovery characteristics of desflurane versus sevoflurane in morbidly obese adult surgical patients: A prospective, randomized study. *AnesthAnalg* 2004;99:1848-53.

