(International Print/Online Journal)

SJIF IMPACT FACTOR: 4.617
PUBMED-National Library of Medicine ID-101739732

ISSN (Print): 2209-2870
ISSN (Online): 2209-2862

International Journal of Medical Science and Current Research (IJMSCR)
Available online at: www.ijmscr.com
Volume3, Issue 1, Page No: 401-406
January-February 2020

Comparison of the recovery profile of isoflurane and sevoflurane based anaesthesia for upper abdominal surgery

[1]Dr. Chingangbam Rabindra Singh, [2]Dr. Takhelmayum Hemjit Singh*, [3]Dr. Laithangbam Pradip Kumar Singh
[4]Dr. Nongthonbam Ratan Singh, [5]Dr.Rupendra Singh Thokchom [6]Dr. Yumnam Arunkumar Singh
[1]Senior Resident, [2, 5]Associate Professor, [3,4]Professor, [6]Assistant Professor
Department of anaesthesiology, RIMS, Imphal, India

***Corresponding Author:**
Dr. Takhelmayum Hemjit Singh *
Department of anaesthesiology, RIMS, Imphal, India

Type of Publication: Original Research Paper
Conflicts of Interest: Nil

ABSTRACT

Background

Awareness during anaesthesia has been associated with post-traumatic stress disorder. Some previuos studies had shown no difference in the incidence of awareness with an anaesthetic protocol that maintained bispectral (BIS) index value between 40 to 60 with another protocol that maintained end tidal anaesthetic concentration (ETAC) between 0.7 to 1.3 MAC (Minimum Alveolar Concentration). Again, some studies had shown sevoflurane providing better recovery profile than isoflurane. So, we have decided to compare the recovery profiles in terms of emergence and recovery time and other side effects of isoflurane and sevoflurane.

Material and methods

The study was a randomized, single blinded one conducted in a tertiary care centre, within a time period of two years, in which fifty adult patients of ASA I &II, aged 20-60 years of either sex were randomized into two groups as S and I to receive 0.5-1 MAC of sevoflurane (1-2%) and isoflurane (0.6-1.2%) respectively. Intraoperative haemodynamic parameters, post-operative outcome such as the extubation, emergence and recovery time and other side effects were recorded.

Results

The intraoperative hemodynamic variables such as heart rate and blood pressure were comparable in the two groups. Postoperative outcome such as the extubation, emergence and recovery time were prolonged in the isoflurane group ($P<0.05$)

Conclusion

Sevoflurane provides better recovery profiles in terms of extubation, emergence and recovery time than isoflurane

Keywords: Sevoflurane, isoflurane, recovery profile, minimum alveolar concentration

INTRODUCTION

Awareness during anaesthesia has been associated with post-traumatic stress disorder and medico-legal consequences for the anaesthetist.[1] Hardman JG et al[2] reported awareness with an incidence of 1 in 3000 anaesthetics and opined that the most frequent cause of awareness is selection of inadequate dose of anaesthetic agents. Haemodynamic parameters, used to adjust the depth of anaesthesia can be altered by various perturbations.[3,4] Monitoring electroencephalographic(EEG) based parameters like

bispectral (BIS) index has been used to maintain adequate depth of anaesthesia, with awareness usually reported with BIS values as low as 40. [5]

A study (B-Unaware trial)[6] has shown no difference in the incidence of awareness with an anaesthetic protocol that maintained BIS value between 40 to 60 with another protocol that maintained end tidal anaesthetic concentration (ETAC) between 0.7 to 1.3 MAC(Minimum Alveolar Concentration). Since monitoring ETAC is an indirect method, its success in preventing awareness comes at the expense of overdosing some patients.[7] Again some study[8] has shown that loss of consciousness occur at 0.5MAC and anterograde amnesia at lower concentration (~0.25MAC). However, the ratio of MAC to MAC-awake varies widely among general anaesthetics suggesting that MAC cannot be used to define or predict brain states in anaesthetized patients.[9] But the MAC concept is widely accepted and still currently in use.

In the meantime, Shah et al[10] study has shown that both sevoflurane and isoflurane anaesthesia provide similar hemodynamic stability. But as compared with isoflurane, sevoflurane allows a smoother, more rapid emergence and better quality of induction and recovery with relative lack of airway hyperreactivity. Also, the studies of Bennet SR et al[11] and Edward JJF et al[12] have shown similar hemodynamic effects but heart rate tends to be higher in the isoflurane anaesthesia and concluded that sevoflurane has possible advantage effects on heart rate and recovery from anaesthesia.

Hence, taking into above considerations in our study, we have decided to compare the recovery profiles in terms of emergence time, recovery time and other side effects of sevoflurane and isoflurane after maintaining intraoperative anaesthesia between 0.5 and 1 MAC of the inhalational agents.

Materials and methods

The study was a randomized, single blinded one, conducted in a tertiary care centre, at Imphal, Manipur, within a time period of two years, in which fifty adult patients of ASA I &II, aged between 20-60 years of either sex, undergoing major surgery of duration less than 4 hours were recruited for the study after taking approval from the Institute Ethics Committee and written informed consent from the patient. Obese patients, patient with history of obstructive sleep apnea and anticipated difficult airway, smoker in the last 48 hours and patients with active respiratory tract infection were excluded from the study.

Patient were divided into two groups of 25 patients each based on computer generated randomization as group S- to receive sevoflurane 1-2% (0.5-1MAC) and group I- to receive isoflurane 0.6-1.2% (0.5-1MAC). An uniform anaesthetic technique were advocated for all the patients. All patients received premedication with tab. ranitidine 150mg and tab. metoclopramide 10mg in the morning of surgery 2 hours before induction of anaesthesia. On arrival at the pre-operative room intravenous access was gained using 18G venous catheters and maintenance intravenous fluid was started. Inj. glycopyrolate 0.004mg/kg was given intravenously. Inside the operation theatre, monitoring of heart rate, noninvasive blood pressure (NIBP), oxygen saturation (SpO_2) and electrocardiogram (ECG) were started. Inj. butorphanol 20μg/kg iv was given before induction of anaesthesia. After pre - oxygenation for 3 minutes, anaesthesia was induced with propofol 1.5-2 mg/kg followed by injection rocuronium 0.9mg/kg to facilitate endotracheal intubation. Just after endotracheal intubation anaesthesia was maintained with sevoflurane 1-2% or isoflurane 0.6-1.2% combined with 50% nitrous oxide in oxygen according to the group assigned and it was blinded to the investigator. Total fresh gas flow was kept at 2L/min (50% N_2O and 50% O_2) and ventilation was adjusted to keep $ETCO_2$ (End Tidal Carbondioxide) between 30 – 35mmHg.

Intra-operative haemodynamic parameters were monitored every 2 minutes for the first 10 minutes, then every 5 minutes till the end of surgery. All the inhalational agents were cut 10 minutes before the anticipated ending of skin closure and inj. ondansetron 0.1mg/kg was given along with inj. diclofenac 75mg IM. Nitrous oxide was cut 3 min before reversal of residual neuromuscular blockade which was done with inj. neostigmine 0.05mg/kg and glycopyrrolate 0.008mg/kg.

Extubation was done when the patient had adequate spontaneous respiratory effort and emergence time was taken as the time from cutting the inhalational agents to eye opening on command.Recovery time

Volume 3, Issue 1; January-February 2020; Page No.401-406
© 2020 IJMSCR. All Rights Reserved

assessed in PACU (Post Anesthesia Care Unit) was taken as the time from cutting the inhalational agents to reach a modified Aldrete Score ≥ 9[13]. Time to first analgesic request was also noted in the PACU and rescue analgesic was given with inj. diclofenac 75 mg IM. Other complications like airway hyperreactivity, post-operative nausea and vomiting (PONV), shivering and unpleasant memories were also recorded.

Sample size was determined based on a previous study[14] where we need 20 patients for each group, with an α value of 0.05 and power of 0.80 (i.e. 80%) and rounded to 25 patients in each group considering any dropouts which might arise in the study. Datas collected was entered in IBM SPSS Statistics 21 for Windows (IBM Corp. 1995, 2012). Categorical datas were analysed using chi-square test or fischer exact test, and t test for continuous variable, etc whichever were appropriate were utilized. A P-value of <0.05 was taken as significant.

Results and observation

The study protocols were completed in all the enrolled patients. The demographic parameters such as age, sex, ASA and duration of surgery and anaesthesia were comparable in the two groups and statistically not significant, as shown in table 1. The intraoperative haemodynamic variables such as heart rate and mean arterial pressure were almost comparable in the two groups at different time points and statistically not significant.

The postoperative outcome such as the extubation time, emergence time and recovery time were prolonged in the isoflurane group and statistically significant (shown in table 2).

The time to rescue of first analgesia was longer in sevoflurane than that of isoflurane but the finding was statistically insignificant (p>0.05). There were no incidence of nausea, vomiting, shivering, airway obstruction, irritation and unpleasant memories in the two groups.

Discussion

The haemodynamic parameters such as HR and MAP were almost comparable in both the groups throughout the intraoperative period even though it was slightly higher in the isoflurane group and similar findings were also recorded in the study of Jan MK et al[15] and Patel M et al[16] .

In our study, the time from the stoppage of inhalational agent to the time of extubation, emergence and recovery time were recorded and it was found to be significantly lesser in the sevoflurane group as compared to isoflurane group and similar findings were reported by Sahu DK et al[17] and Gupta A et al[18]where they found that emergence from sevoflurane was significantly quicker as compared to isoflurane.

Bennett SR et al[11] and Farrukh R et al[19] also found better recovery profile in sevoflurane group in term of eye opening, emergence time and extubation time. Also Gauthier A et al[20] found sevoflurane to have better recovery profile than isoflurane in their study.

Isoflurane group recorded insignificant earlier rescue analgesic time as compared to sevoflurane in our study and similar results were reported in the study of Sahu DK et al[17] . There were no incidences of nausea, vomiting and shivering in both the groups in our study and this had also been reported by Frink et al[21], Sahu DK et al[17] and Elcock DH et al[22]. In our study we did not find any incidences of airway obstruction and hyperactivity in both the groups and the same finding were cited in the study by Inomata S et al[23]. There was no incidence of severing in both the groups in our study which were also not reported in other studies of Sahu DK et al[17], Smith I et al[24], Frink EJ et al[21] etc.

Our study could not ilicit any incidence of intraoperative unpleasant memory such as vague recollection of events like sounds, fearful episodes, bad dreams, pain during surgery etc. in both the groups, which may be due to the small sample size for determinig its incidence. The study of Sebel PS et al[25] demonstrates that the incidence of awareness with recall after general anesthesia (0.13%) in the US is comparable to that described in other countries i.e. 1 to 2 cases per 1000, irrespective of geographic location and potential differences in anesthetics and techniques. Their study also reported that dreaming during anesthesia was described by 6% of their study population, and this was consistent with the common occurrence of perioperative dreaming reported in several small European studies. Sandin R et al[1] did a study in which they reported that during 0.1–0.2% of operations with general anesthesia, patients become

© 2020 IJMSCR. All Rights Reserved

aware during surgery. Hardman JG et al[2] reported that awareness occurs after 1 in 3000 anaesthetics; it is twice as likely when neuromuscular blockade is used.

Thus sevoflurane has the advantage of quicker emergence time, quicker extubation time and faster recovery in comparison to isoflurane.

Limitations:

The limitations of our study are:-

1. We have not used any method for monitoring the depth of anaesthesia. Our titration of anaesthesia keeping MAC between 0.5 to 1 MAC is based on earlier studies.[4,8]
2. Intraoperative awereness need to be assessed in large sample size as its incidence is low.
3. We have not included cost effectiveness analysis during the study due to limited resource.

Conclusion

Sevoflurane has the advantage of better recovery profiles in terms of emergence time, extubation time and recovery time than isoflurane anaesthesia eventhough they have comparable haemodynamic stability and post opearative complications like nausea, vomiting, unpleasant memory, airway obstruction and severe airway hyperreactivity.

References

1. Samuelson P, Brudin L, Sandin RH. Late psychological symptoms after awareness among consecutively included surgical patients. Anesthesiology 2007;106:26-32.
2. Hardman JG, Aitkenhead AR. Awareness during anaesthesia. B J A 2005 1;5(6):183-6.
3. Kumar SS, Kumar A, Mahajan R, Katyal S, Mann S. Comparison of recovery profile of propofol and sevoflurane anesthesia in cases of open cholecystectomy. Anesth Essays Res 2013;7(3):386-9.
4. Khalid A, Siddiqui SZ, Aftab S, Sabbar S, Haider S. Recovery profile - a comparison of isoflurane and propofol anesthesia for laparoscopic cholecystectomy. J Coll Physicians Surg Pak 2008;18(6):329-33.
5. Drummond JC. Monitoring depth of anaesthesia. Anaesthesiology 2000;93:876-82.
6. Avidan MS, Zhang L, Burnside BA, Finkel KJ, Searlemen AC, Selvidge JA et al. Anaesthesia awareness and the bispectral index. N Engl J Med 2008;358:1097-108.
7. Emery NB, Ken S, Patric LP, Oluwaseun JA. Monitoring Brain State during general anesthesia and sedation. In: Miller R, editor. Anesthesia. 8th edition. Philadelphia: Elsevier Saunders;2015.p.1524-40.
8. Brown E, Lydic R, Schiff ND. General Anaesthesia, sleep and coma. N Engl J Med 2010;363:2638-50.
9. Solt K, Forman SA. Correlating the clinical actions and molecular mechanism of general anesthetics. Current Opinion Anesthesiol 2007;20:300-6.
10. 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(2):2001-9.
11. Bennett SR, Griffin SC. Sevoflurane versus Isoflurane in patients undergoing valvular cardiac surgery. J Cardiothoracic Vasc Anaesth 2001;15(2):175-8.
12. Edward JF, Philip TM, Matthew A, Luis MD, James ND, Burnell RB. Clinical comparison of sevoflurane and isoflurane in healthy patients. Anesth Analg 1992;74(2):241-5.
13. Aldrete JA, Kroulik D. A postanesthetic recovery score. Anesth Analg 1970;49:924-34.
14. Nordmann GR, Read JA, Sale SM, Stoddart PA, Wolf AR. Emergence and recovery in children after desflurane and isoflurane anaesthesia: effect of anaesthetic duration. Br J Anaesth 2006;96(6):779-85.
15. Jain MK, Shah MH. Comparison of induction, maintenance and recovery characteristics of

© 2020 IJMSCR. All Rights Reserved

sevoflurane - N_2O and propofol-sevoflurane - N_2O with propofol-isoflurane-N_2O. J Evolution Med Dent Sci 2014;3(62):13645-54.

16. 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.
17. Sahu DK, Kaul V, Parampill R. Comparison of isoflurane and sevoflurane in anaesthesia of day care surgeries using classical laryngeal mask airway. Indian J Anaesth 2011;55:364-9.
18. Gupta A, Stierer T, Zuckerman R, Sakima N, Parker SD, Fleisher LA. Comparison of Recovery Profile After Ambulatory Anesthesia with Propofol, Isoflurane, Sevoflurane and Desflurane: A Systematic Review. Anesth Analg 2004;98:632-41.
19. Farrukh R, Awana WS, Aziz Jillani MA. Comparison of Recovery Characteristics of Sevoflurane and Isoflurane in Obese patients. P J M H S 2014;8(1):119.
20. Gauthier A, Girard F, Boudreault D, Ruel M, Todorov A. Sevoflurane provides faster recovery and post-operative neurological assessment than isoflurane in long-duration neurological cases. Anesth Analg 2002;95(5):1384-8.
21. Frink EJ, Malan TP, Atlas M, Dominguez LM, Dinardo JA, Brown BR. Clinical comparison of sevoflurane and isoflurane in healthy patients. Anesth Analg 1992 ;74:241-5.
22. Elcock DH, Sweeney BP. Sevoflurane vs Isoflurane: A clinical comparison in day surgery. Anesthesia 2002;57:52-6.
23. Inomata S, Yaguchi Y, Taguchi M, Toyooka H. End-Tidal sevoflurane concentration for tracheal extubation (MACex) in adults: comparison with isoflurane. Br J anesth 1999;82(6):852-6.
24. Smith I, Ding Y, White PF. Comparison of Induction, maintenance, and recovery characteristics of sevoflurane-N_2O and propofol-sevoflurane-N_2O with propofol-isoflurane-N_2O. Anesth Analg 1992;74(2):253-9.
25. Sebel PS, Bowdle TA, Ghoneim MM, Rampil IJ, Padilla RE, Gan TJ et al. The incidence of awareness during anaesthesia: a multicentric United States study. Anesth Analg 2004;99:833-9.

Table 1: Comparison and distribution of demographic variables in the two groups

Parameters	**Sevoflurane**	**Isoflurane**	**Statistical test value**	**P value**
Age in years (mean±SD)	34.42±8.22	35.58±7.85	t test value of0.51	0.61
Sex (male/female)	2/22	0/25	Fischer exact value of 3.19	0.23
ASA (I/II)	24/1	23/2	Fischer exact value of 0.35	1.00
Duration of surgery in minutes (mean±SD)	64.92±36.27	60.08±18.11	t test value of 0.57	0.55
Duration of anaesthesia in minutes (mean±SD)	65.44±39	57.76±18.63	t test value of 0.37	0.38

Volume 3, Issue 1; January-February 2020; Page No.401-406
© 2020 IJMSCR. All Rights Reserved

Table 2: Distribution and comparison of postoperative outcomes in the two groups

Parameters	**Sevoflurane** *(mean±SD)*	**Isoflurane** *(mean±SD)*	**'t' test value**	**P value**
Extubation time in minutes	11.68±2.56	13.68±3.53	2.29	0.02*
Emergence time in minutes	13.28±2.70	15.32±3.78	2.19	0.03*
Recovery time in minutes	18±2.84	23.76±5.28	4.79	0.000*
Time to first rescue analgesic in minutes	77.56±43.15	68.44±48.99	0.69	0.49

*= Significant

Volume 3, Issue 1; January-February 2020; Page No.401-406
© 2020 IJMSCR. All Rights Reserved