wjpmr, 2021,7(10), 150-155

SJIF Impact Factor: 5.922

WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.wjpmr.com

Research Article

ISSN 2455-3301

WJPMR

COMPARISON OF HALOTHANE AND SEVOFLURANE ON HEMODYNAMICS AND EASE OF (LMA) INSERTION IN PEDIATRIC PATIENTS: A TERTIARY CARE EXPERIENCE

Basharat Saleem*[1], Sadia Ali[2] and Shazia Ashraf[3]

[1]Professor, HOD, Department of Anesthesiology, Govt. Medical College, Baramullaha, India.
[2]Anaesthetist, JLNM Hospital, Srinagar, India.
[3]Anaesthetist, Covid Hospital, DRDO Srinagar, India.

***Corresponding Author: Basharat Saleem**

Professor, HOD, Department of Anesthesiology, Govt. Medical College, Baramullaha, India.

Article Received on 28/06/2021 **Article Revised on 18/07/2021** **Article Accepted on 08/08/2021**

ABSTRACT

Background: An area where sevoflurane might be expected to find increasing use is that of laryngeal mask airway (LMA) insertion which is becoming more frequent in paediatric ambulatory surgery as this avoids some of the hazards of endotracheal intubation. **Objective:** To compare the acceptance characteristics and ease of laryngeal mask airway (LMA) insertion with halothane and sevoflurane in pediatric patients undergoing short elective surgical procedures. **Methods:** Observational prospective study was conducted in Postgraduate Department of Anesthesiology and Critical Care, Government Medical College, Srinagar (J&K). A profile of 100 patients were taken in the consideration for this studied. Patients receiving halothane designated "H" (n=50) were compared with patients receiving sevoflurane designated "S" (n=50). Patients in the age group of 1-12 years belonging to ASA I and II undergoing short elective operative procedures under general anesthesia were included in the study. Anaesthesia was induced using face mask of appropriate size and Jackson-Rees circuit or non-re breathing circuit as per the weight of the patient, with 50% nitrous oxide in 50% oxygen and incremental concentrations of the volatile anesthetic agent to be studied. **Results:** The mean time required from start of induction to onset of regular respiration (seconds) in group H was 79.08±10.66 and in group S was 43.24±11.4. The results were statistically significant with a p value of < 0.05. The mean time required from the start of induction to loss of eye lash reflex (seconds) in group H was 109.28±10.57 and in group S was 72.64±11.30. The results were statistically significant with a p value of < 0.05. The mean time required from start of induction to jaw relaxation (seconds) in group H was 235.90±17.64 and in group S was 149.76±17.68. The results were statistically significant with a p value of < 0.05. The mean time required from start of induction to centralization of eye balls (seconds) in group H was 252.26±17.10 and in group S was 166.62±17.93. The results were statistically significant with a p value of < 0.05. In both the groups, condition at LMA insertion and patient response were found satisfactory, LMA was inserted successfully in first attempt in 49 patients in group H and 47 patients in group S. **Conclusion:** Sevoflurane had a better hemodynamic stability. Hence, we conclude that sevoflurane is a suitable alternative to halothane for inhalational induction of anaesthesia especially in children.

KEYWORDS: Sevoflurane, halothane, general anesthesia, induction, laryngeal mask airway (LMA).

INTRODUCTION

Inhalational induction of anaesthesia remains a fundamental technique in paediatric anaesthesia. Children prefer to avoid injections, and intravenous cannulation in awake, small infants is often difficult. Unfortunately, induction by inhaling halothane causes many children to cry, because of its odour. Sevoflurane not only has a slightly sweet smell but is also rapidly effective because of its low blood gas solubility coefficient (0.6) and the lack of airway irritation. As sevoflurane is both appreciably quicker and as safe as halothane, it should be preferred for induction.[1]

Sevoflurane is an attractive alternative to halothane in outpatient surgery because of lesser myocardial sensitization to catecholamines and low blood gas solubility, hence associated with more rapid induction and recovery from anaesthesia. However emergence delirium, production of compound A.[2,3,4] are some of the feared disadvantages of Sevoflurane use.

The Paediatric Anaesthesiologists usually prefer anaesthetic techniques associated with a rapid and smooth induction and emergence, early feeding and smooth uneventful postoperative recovery. Many paediatric patients are not premedicated and may arrive

in operating room anxious and crying, usually having elevated serum catecholamine levels; hence more liable to develop cardiac dysrhythmias with halothane anaesthesia.[5]

Anaesthetic management of paediatric age group is unique because these patients are more vulnerable to anesthetic complications and thus need a special consideration. Safe anesthetic management depends upon full appreciation and understanding of physiological, anatomical and pharmacological characteristics of each age group.[6]

Different induction methods and insertion techniques have been studied to find an optimal method for LMA insertion in different situations. Children, if properly premedicated, better tolerate inhalational induction. In children the inhalational induction before LMA insertion proved better as there is greater propensity for laryngospasm in children with intravenous induction.[7]

METHODS

Setting and Design

This prospective observational study was conducted in Postgraduate Department of Anesthesiology and Critical Care, Government Medical College, Srinagar and associated Hospitals after obtaining approval from Institutional Ethical Committee. An informed written consent was obtained from the parents/guardian of the patients after subjecting them to preanesthetic evaluation.

A total of 100 patients were included in this study. Patients receiving halothane designated "H" were compared with patients receiving sevoflurane designated "S".

Inclusion criteria

Patients in the age group of 1- 12 years belonging to ASA I and II undergoing short elective operative procedures under general anaesthesia.

Exclusion criteria

1. ASA III and above
2. Patient's attendants' refusal.
3. Patients with anticipated difficult airway.
4. Any contraindication to drugs under study.
5. Short surgical procedures which cannot be done using LMA.

All the patients included in the study were pre-medicated with Injection glycopyrollate 6mcg/kg(im) and syrup Triclofos 20mg/kg (orally) one hour before surgery.

Anaesthesia was induced using face mask of appropriate size and Jackson-Rees circuit or non-rebeathing circuit as per the weight of the patient, with 50% nitrous oxide in 50% oxygen and incremental concentrations of the volatile anesthetic agent to be studied.

In patients receiving halothane, the inspired concentration was set at 0.5% initially followed by stepwise increase of 0.5% every 3 to 4 breaths upto a maximum of 3.5% until the loss of eyelash reflex occurred. In patients receiving sevoflurane the inspired concentration was set at 1% initially and increased gradually by 1% upto a maximum of 6% until the loss of eyelash reflex occurred.

Struggling score[1] till the loss of eye lash reflex (struggling score 0 – No movement, 1 – head movement, 2-Head and limb movement, 3-severe struggle), time of loss of eyelash reflex, time of onset of regular respiration, time of centralization of eyeballs and time of adequate jaw relaxation was noted in every patient.

Proper size LMA- proseal was inserted using standard technique when eyeballs were centralized and the jaw was relaxed.

The hemodynamic parameters were recorded as follows

- Baseline
- Immediately before induction
- Immediately before insertion of LMA
- 1 minute after insertion of LMA
- 3, 5 and 10 minutes after insertion of LMA

Complications were noted and treated immediately.
At the time of LMA insertion the following parameters were noted

- Jaw opening: Full-3, Partial-2, Nil-1
- Ease of insertion: Easy-3, Difficult-2,Impossible-1
- Number of attempts.
- Limb/head movements: nil-3, slight-2, gross-1
- Coughing: nil-3, slight-2, gross-1
- Phonation
- Need for tracheal intubation.

Conflict of interest: Nil.

Funding: Nil.

RESULTS

An observational study was done over a period of 20 months in Postgraduate Department of Anesthesiology and Critical Care, Government Medical College, Srinagar and associated Hospitals after obtaining approval from Institutional Ethical Committee. Patients were comparable regarding their demographic profile (Table 1).

Table 1: Demographic profile of the study population.

Parameters	Group H n=50	Group S n=50	P value
Age (yrs)	3.17±1.58	3.13±1.34	0.796*
Weight (kg)	16.02±2.591	16.22±3.551	0.837*
ASA I/II	46/4	45/5	0.676*
Sex Male/Female	40/10	38/12	0.567*
Duration of surgery	33.5±6.63	35.9±7.42	0.306*

(Mean, SD= standard deviation,* = level of significance)

The mean heart rate (beats/min) in both the studied groups before induction was 132.34±3.55 (Group H) and 131.36±3.71 (Group S). Before LMA insertion the mean heart rate in group H was 121.30±3.74 and in group S it was 128.22±3.57. At LMA insertion the heart rate in group H was 125.28±4.04 and in group S it was 129.60±3.92. The heart rate at 1 minute after insertion, 3 min after insertion and 5 min after insertion was 113.54±4.18, 108.08±2.92 and 105.12±4.08 in group S and in group H it was 127.34±3.59, 125.08±3.58 and 122.36±3.72 respectively (Fig 1).

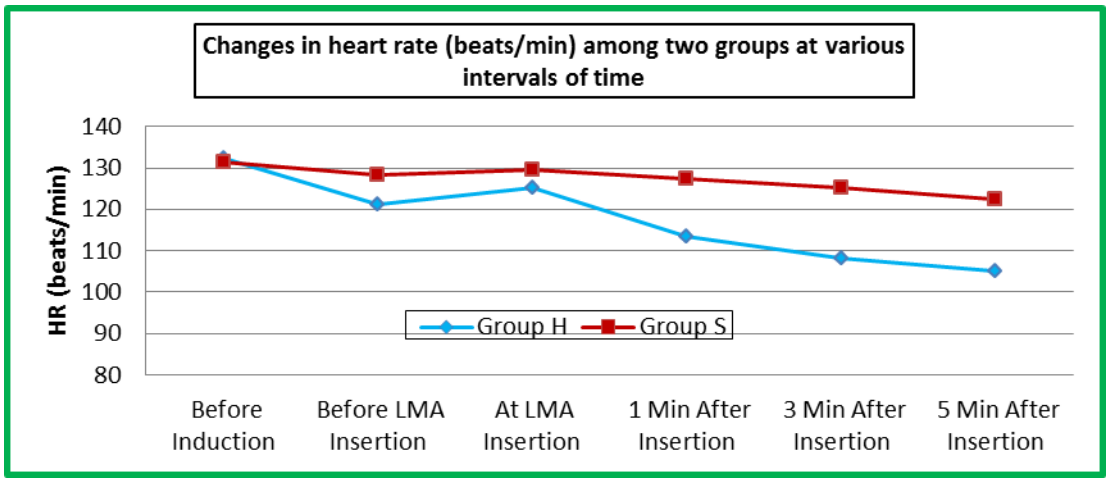

Fig. 1:

The mean systolic blood pressure [SBP] (mmHg) in both the studied groups before induction was 101.54±3.30 (Group H) and 102.28±3.25 (Group S). Before LMA insertion the SBP in group H was 94.18±2.78 and in group S it was 99.12±3.34. At LMA insertion the mean SBP in group H was 96.34±3.59 and in group S it was 101.46±3.25. The SBP at 1 minute after insertion, 3 min after insertion and 5 min after insertion was 88.08±3.36, 85.08±3.06 and 82.46±3.01 in group S and in group H it was 97.82±2.70, 95.48±2.76 and 92.90±2.96 respectively (Fig 2).

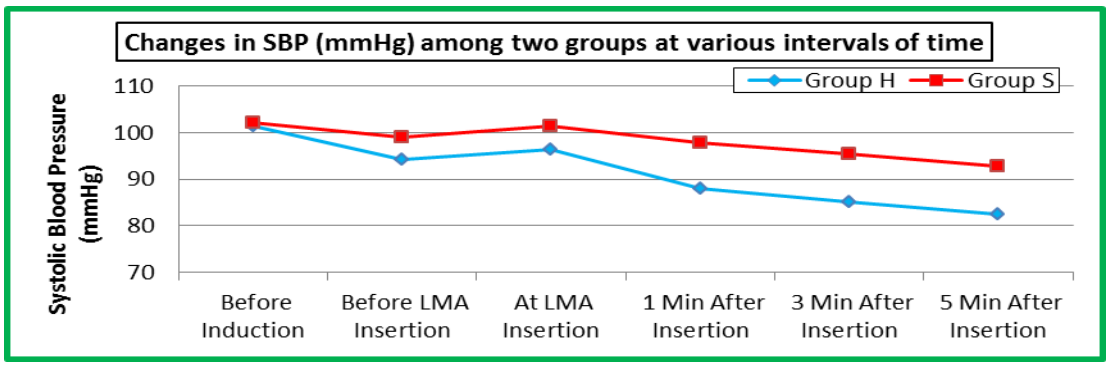

Fig.2:

The mean diastolic blood pressure [DBP] (mmHg) in both the studied groups before induction was 70.22±2.63 (Group H) and 70.78±2.76 (Group S). Before LMA insertion the DBP in group H was 67.28±2.66 and in group S it was 69.22±2.63. At LMA insertion the mean DBP in group H was 68.48±2.84 and in group S it was 69.80±2.62. The DBP at 1 minute after insertion, 3 min after insertion and 5 min after insertion was 63.48±3.17, 61.92±3.53 and 60.42±3.59 in group S and in group H it

was 67.58±3.01, 65.92±2.83 and 64.72±2.64 respectively (Fig 3).

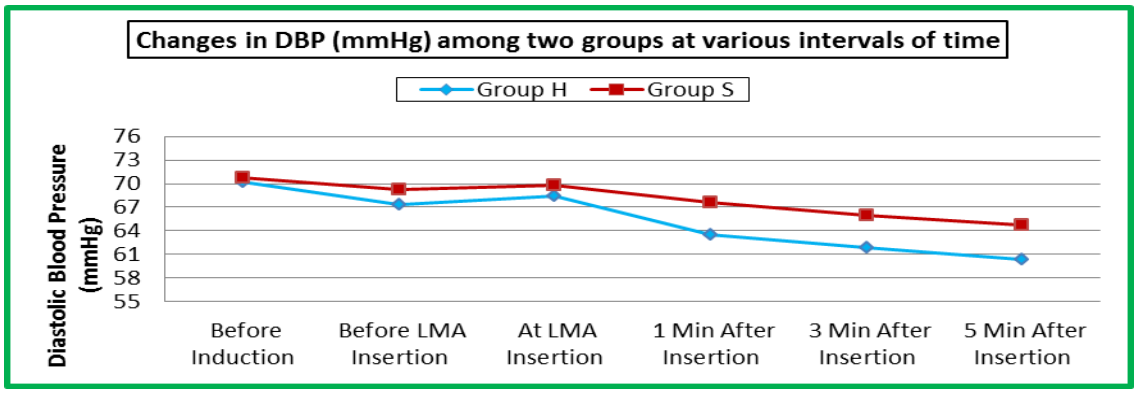

Fig. 3:

The mean oxygen saturation [SpO_2] (%) in both the studied groups before induction was 98.82±1.10 (Group H) and 98.76±1.10 (Group S). Before LMA insertion the SpO2 in group H was 99.20±0.83 and in group S it was 99.10±0.89. At LMA insertion the mean SpO2 in group H was 99.12±0.98 and in group S it was 99.10±1.06. The SpO2 at 1 minute after insertion, 3 min after insertion and 5 min after insertion was 98.64±0.84`, 90.92±3.53 and 60.42±3.59 in group S and in group H it was 67.58±3.01, 65.92±2.83 and 64.72±2.64 respectively (Table 2).

Table 2: Changes in SpO_2 (%) among two groups.

Spo_2	Group H	Group S	P Value
SPo2 Before Induction	98.82±1.10	98.76±1.10	0.786
SPo2 Before LMA Insertion	99.20±0.83	99.10±0.89	0.562
SPo2 At LMA Insertion	99.12±0.98	99.10±1.06	0.922
SPo2 1 Min After Insertion	98.64±1.12	98.60±1.12	0.858
SPo2 3 Min After Insertion	98.84±0.98	98.80±0.99	0.838
SPo2 5 Min After Insertion	99.08±0.99	99.02±0.97	0.758

Conditions at LMA insertion and patient response among two groups (Fig 4).

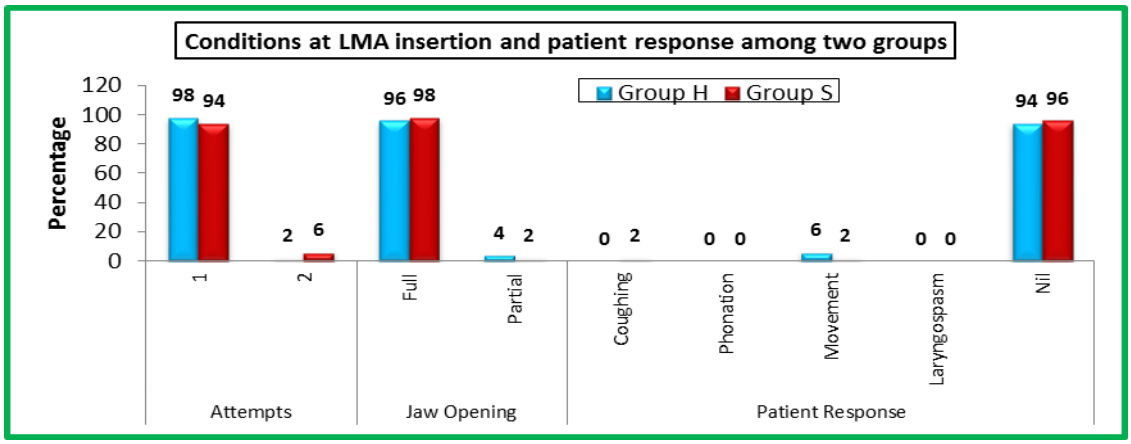

Fig. 4:

DISCUSSION

Characteristics of an ideal inhalational anesthetic include ample potency, low solubility in blood and tissues, resistance to physical or metabolic degradation and lack of injury to vital tissues.[8] Although no single anesthetic agent completely satisfies all these requirements, pharmacological developments have brought us considerably closer to better choices.[9]

The introduction of fluorinated hydrocarbons into clinical practice provides one of the greatest landmark in the development of anaesthesia. Nowadays these

fluorinated hydrocarbonated agents are used very frequently in paediatric patients as inhalational agents.

In the present study Syrup Triclofos at a dose of 20mg/kg was given 1 hr before induction as a premedication in both the groups. About 70% of the patients did not get sedated however acceptance of mask was comparatively better in sedated patients than in non-sedated patients. Overall there was no significant effect of sedation on outcome of induction. Injection Glycopyrolate 6mcg/kg (im) was also used 1 hr prior to induction as a premedication for decreasing the secretions in both the groups.

In our study induction with halothane was started as 0.5% and increased stepwise by 0.5% every 3 to 4 breaths till the loss of eye lash reflex to a maximum of 3.5% in 50:50 oxygen and nitrous oxide, while sevoflurane was started at 1% and increased gradually to a maximum of 6% until the loss of eyelash reflex. This was done to obtain comparative values in terms of MAC for both halothane and sevoflurane respectively. **Black et al (1996)[10]** had also used increments of 0.5 to 1% to a maximum of 5% for halothane and 1.5 to 2% increment to a maximum of 7% for sevoflurance in their study. Gradual increase in concentration was carried out in our study to avoid excitement phase of induction. **Sigston PE et al (1996)[11]** used 8% sevoflurane after priming the circuit with sevoflurane which resulted in faster induction but it was associated with a considerable amount of excitement and adverse airway reaction. We did not encounter any case of excitement or any adverse airway reaction in our stepwise incremental strategy.

In our study a struggling score of 2 was observed in 3 patients receiving halothane and a struggling score of 1 was observed in 1 patient receiving sevoflurane. Similar results were seen by **Sigston PE et al (1996)[11]** who found sevoflurane as more pleasant inhalational agent.

Due to low blood gas solubility of sevoflurane, induction is faster with sevoflurane when compared with halothane. Time of loss of eyelash reflex, time of onset of regular respiration, time of adequate jaw relaxation, time of centralization of eye balls was uniformly lesser in sevoflurane group than in halothane group.

Mean time required for loss of eyelash reflex was 109.28 for group “H” and 72.68 for group “S”. The difference observed between the two study groups was statistically significant (p value < 0.001). Similar results were noted by **Black et al (1996)[10]** where sevoflurane caused a loss of eyelash reflex more quickly than halothane by approximately 40 seconds.

Mean time required for jaw relaxation was 235.90 seconds for group H and 149.76 seconds for group S. The difference observed was statistically significant with p value <0.001. Similar findings were observed by **Dr. Kajal N Dedhia et al (2004)[11]** in their study.

Centralization of eye ball was considered to be the end point of LMA insertion in our study. Mean time for centralization of eyeball was 252.26 seconds for group H and 166.62 seconds for group S. The difference observed between the two groups was statistically significant (p value < 0.001). **Dr. Kajal N Dedhia et al (2004)[11]** in their study also found induction with sevoflurane to be faster (164.8±39.73) than halothane (249.83±40.58) with a p value of < 0.001. **Black et al (1996)[10]** also found that time required for centralization of eye balls was faster with sevoflurane.

In the present study, successful LMA insertion was achieved in the first attempt in 49 and 47 patients in group H and group S respectively. The difference observed between the two groups was statistically insignificant (p value 0.617). **Manish Patel et al (2016)[12]** in their study observed that all patients in sevoflurane group were intubated in first attempt whereas in Halothane group 90% of patients were intubated in first attempt and rest in second attempt.

In the present study, the mean baseline heart rates of the two groups before induction were comparable and the difference was not statistically significant (group H 32.34, group S 131.36, p value 0.180). The mean heart rate before LMA insertion and 1 min, 3 min, 5 min after insertion was less in group H as compared to group S. The difference between the mean heart rate of the two groups were statistically significant before LMA insertion and 1, 3, 5 minutes after insertion with a p value < 0.005. However there was slight increase in heart rate in both the groups at the time of LMA insertion. Clinically significant bradycardia was seen in 4 patients in group H and 1 patient in group S. In a study by **Woody E et al (1997)[13]** sevoflurane did not alter heart rate while halothane cause a reduction in heart rate. **Black et al (1996)[10]** found that both agents caused similar effect on heart rate during the course of induction. None of our patients in either of the groups had any arrhythmia during induction. **Johannesson GP et al (1995)[14] and Lerman J et al (1996)[15]** noted that the incidence of arrhythmia was higher in halothane group than in sevoflurane group. In a study conducted by **Girotra S (1999)[16]** there was no change in cardiac rhythm in sevoflurane group but in halothane group 60% of children had arrhythmias. The results in their study were significant with a p value of < 0.001. The occurrence of arrhythmias was probably because of the higher concentration of the drugs used in their study.

In the present study, mean baseline systolic arterial blood pressure of the two groups was comparable and the difference was not statistically significant (group H 101.54, group S 102.28, p 0.261). The systolic blood pressure before LMA insertion and 1, 3, 5 min after insertion was less in group H as compared to group S. The difference between mean systolic blood pressure of the two groups was statistically significant before LMA insertion and 1, 3, 5 min after insertion (p value < 0.001).

However, there was slight increase in mean systolic BP at the time of LMA insertion.

The mean baseline diastolic blood pressure of the two groups was comparable and the difference was not statistically significant (group H 70.22, group S 70.78, p < 0.001). The mean diastolic BP before LMA insertion and 1, 3, 5 min after insertion was less in group H as compared to group S. The difference between the mean diastolic BP of the two groups was statistically significant (p <0.001) before LMA insertion and 1, 3, 5 min after insertion. However there was slight increase in mean diastolic blood pressure at the time of LMA insertion in both the groups.

Saturation remained 97-100% in both the groups, 1 patient in group H had a saturation of 87%. In a study conducted by **Dr. Kajal N Dedhia et al (2004)[11]** oxygen remained between 95-100% with desaturation in 2 patients of sevolfurane group, **Koprulu AS et al (1997)[17]** did not encounter any desaturation in their study.

No laryngospasm, coughing, phonation was seen in either of the groups, however head and limb movements were seen in 3 patients in group H and 1 patients in group S during induction. **Dr. Kajal N Dedhia et al (2004)[11]** reported no significant laryngospasm, coughing phonation and purposeful movement in either of the two groups at the time of LMA insertion in their study.

CONCLUSION

Sevoflurane had a better hemodynamic stability. Hence, we conclude that sevoflurane is a suitable alternative to halothane for inhalational induction of anaesthesia especially in children.

REFERENCES

1. Black, M.R.J. Sury, L. Hemington, R. Howard, A. Mackersie and D. J. Hatch. A comparison of the induction characteristics of sevoflurane and halothane in children. Anaestliesia, 1996; 5(1): 539-542.
2. Shivani Rastogi, (Major) Vishal Arora, Imran Khan, Rajlaxmi Bhandari, Mohammad Zafeer Khan, Atit Kumar. "A comparative study of sevoflurane vs halothane for general anaesthesia in pediatric patients". Journal of Evolution of Medical and Dental Sciences, 2013; 2(44): 8678-8689.
3. Ruiz-Neto PP, Halpern H, Cremonesi E. Rapid inhalation induction with halothane-nitrous oxide for myasthenic patients.Can J Anaesth, 1994; 41: 102-6.
4. Smith I, Nathanson MH, White PF. The role of Sevoflurane in Outpatient Anesthesia. Anesth Anesth Analg Analg, 1995; 81: S67-72.
5. Vecil M, Stefano CD, Zorzi F, Saltarini M, Monte AD. Low flow, minimal flow and closed circuit system inhalational anesthesia in modern clinical practice. Signa Vitae, 2008; 3: S33-36.
6. John F Butterworth, David C Mackey, John D Wasnick. Morgan and Mikhail's Clinical Anesthesia. 5th edition. New Delhi. McGraw Hill Education Private Limited.
7. Ghatge S, Lee J, Smeth I. Sevoflurane: An ideal agent for day care anesthesia. Acta Anesthesiol Scand, 2003; 47: 917-31.
8. Edmond Eger. Characteristics of anesthetic agents used for induction and maintenance of general anesthesia. AM J Health Systemic Pharmacology, 2004.
9. Black A, Sury MRJ, Haemington L, Howard RFI, Mackerise AM, Hatch DJ. A comparison of the induction characteristics of sevoflurane and halothane in children. Anaesthesia, 1996; 51: 539-542.
10. Sigston PE, Jenkin AMC, Jackson CA, Sury MRJ, Mackerise AM, Hatch DJ. Rapid inhalation induction in children: 8% sevoflurane compared with 5% halothane. Br J Anaesth, 1997; 78: 362-365.
11. Dr. Kajal N. Dedhia Dr. Amala Kudalkar. Comparison of sevoflurane and halothane for induction of anaesthesia and laryngeal mask airway insertion in paediatric patients. Indian J. Anaesth, 2004; 48(6): 465-468.
12. Manish Patil, Sachin Padmawar. Comparison of sevoflurane with halothane as inhalational anaesthetic agent in neonate and paediatric patients. International Journal of Contemporary Medical Research, 2016; 3(7): 1884-87.
13. Wodey E, Pladys P, Copin C, Lucas MM, Chaumont A, Carre P, Lelong B, Azzis O, Ecoffey C. Comparative hemodynamic depression of sev oflurane versus halothane in infants: an echocardiographic study. Anesthesiology, 1997 Oct; 87(4): 795-800.
14. Johannesson GP, Floren M Lindahl. Sevoflurane for ENT-surgery in children: A comparison with halothane. Acta Anaesthesiologica Scandinavica, 1995; 39: 546-550.
15. Lerman J, Davis PJ, Welborn LG, Orr RJ, Rabb M, Carpenter R, Motoyama E, Hannallah R, Haberkern CM. Induction, recovery, and safety characteristics of sevoflurane in children undergoing ambulatory surgery. A comparison with halothane. Anesthesiology, 1996 Jun; 84(6): 1332-40.
16. Girotra S, Singh A, Mehta Y, Iyer KS, Trehan N. Comparison of sevoflurane and halothane for induction and intubation in pediatric cardiac surgical patients. Anesthesia & Analgesia, April 1999; 88: 4S - 61SCA.
17. Koprulu AS, Dogruer K, Karpat H. Sevoflurane versus halothane for Laryngeal Mask Airway (LMA) insertion. Br J Anaesth, 1997; 78: 8.