ORIGINAL ARTICLE

COMPARISON OF MEAN INDUCTION TIME AND EMERGENCE FROM ANESTHESIA BETWEEN SEVOFLURANE AND HALOTHANE IN CHILDREN

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ABSTRACT

Objective: To compare and select the suitable anesthetic agent with rapid induction, smooth rapid recovery, few intra-operative and emergence complications in children.

Material and Methods: This randomized control trial study was conducted in Anesthesia department of Khyber Teaching Hospital Peshawar from 1st January 2011 to 31st December 2012. A total of 67 patients aged between 1-12 years of either sex belonging to ASA physical status I were randomly allocated to two groups of 33 and 34 each. Group a (Sevoflurane group) received Sevoflurane and group b (Halothane group) received Halothane as inhalational anesthetic for both induction and maintenance of anesthesia. Time to induction was recorded and statistical analysis of data was done to compare the two agents.

Results: The Mean age in Halothane group was 6.8 years and in Sevoflurane group was 6.3 years. Male to female ratio was 1.7:1. Mean induction time with Halothane was 117.6 seconds and with Sevoflurane was 96.3 seconds ($p<0.005$). Similarly emergence from anesthesia with Sevoflurane was rapid 11.6 minutes earlier than Halothane ($p=0.001$). Adverse events like excitement, breath holding, secretions, laryngospasm and vomiting were similar and statistically insignificant in Halothane and Sevoflurane groups.

Conclusion: Induction and emergence is rapid with Sevoflurane compared to halothane in children.

Key Words: Mean induction time, emergence, sevoflurane.

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INTRODUCTION

The introduction of fluorinated hydrocarbons into clinical practice provides one of the greatest landmarks in the development of anesthesia. Nowadays these fluorinated hydrocarbons are practiced very frequently in pediatric patients as inhalational induction agents because of difficult venous access[1]. Induction and recovery from anesthesia is influenced by the choice of volatile agent. Among the volatile agents, Halothane and Sevoflurane are used; the later one is gaining more popularity due to its faster induction time and rapid recovery[2].

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Halothane is still widely used in pediatrics especially in under -developed countries because of its low cost, smooth induction and recovery with reasonable patient acceptability. Despite its efficacy and frequency of use, halothane is not an ideal agent because of its high blood-gas and blood-tissue solubility and its potential to cause bradycardia, hypotension and ventricular ectopy. Also when used in combination with incision site local anesthetic agent like xylocaine, it predispose children to arrhythmias[3,4].

Sevoflurane has a wider therapeutic index in terms of cardiovascular depression and depression of ventilatory drive. Many anesthesiologists consider Sevoflurane as the agent of choice for inhalation induction, because of its non-irritating and less pungent odor. With its low blood gas solubility coefficient induction and recovery from general anesthesia is rapid[5,6].

This study was designed to compare the mean induction and emergence time between Sevoflurane

and Halothane among children undergoing elective surgery. The main idea behind doing this study was that in literature there is some variation in the mean induction time between the two drugs and in our study if the mean induction time in Sevoflurane is found to be less than that of halothane, then we will recommend the routine use of Sevoflurane in induction of anesthesia among local children undergoing elective surgery as it is free from side effects associated with Halothane.

MATERIAL AND METHODS

This randomized control trial study was conducted in Anesthesia department of Khyber Teaching Hospital from January 2011 to December 2012 after approval from hospital ethical and research committee. Study. All children under going elective surgery under general anesthesia for short procedures i.e. less than 1 hour and meeting the inclusion criteria were included in this study. Patients of ASA class 3 or 4, having cardio-respiratory disease, coagulopathies, raised intracranial pressure, allergic to drugs used in this study or patients undergoing emergency or prolong surgery were excluded from the study. The purpose and effects of the study were explained to the parents or guardians of the children and a written informed consent was taken from them. A total of 67 patients aged between 1-12 years of either sex belonging to ASA physical status I were randomly allocated to two groups of 33 and 34 each. Group a (Sevoflurane group) received Sevoflurane + Nitrous oxide + Oxygen and group b (Halothane group) received Halothane + Nitrous Oxide + Oxygen as inhalational anesthetic for both induction and maintenance of anesthesia. Face mask of correct size was applied and minimum of either 1% Sevoflurane or 0 .5% Halothane with nitrous Oxide 6 Liters per minute and Oxygen 3 Liters per minute were started and increased in concentration of volatile anesthetic agent was done every 3 breaths of the patient. Concentration was increased till the child is breathing 8% of Sevoflurane & 5% of Halothane. Time to induction i.e. time duration from application of face mask till the loss of eye lash reflex was recorded and statistical analysis of data was done to compare the two agents.

Data was analyzed by using SPSS version 10. Quantitative variables like age and induction time were described in terms of mean ± SD. Categorical variables like gender were described in terms of frequencies and percentages. To know the significant difference in two groups with regards to induction time, T-test was applied keeping P value of ≤0.05 to be significant. Chi-square test was used to find out the possible associations. All the results were elaborated in the form of tables and graphs.

RESULTS

The demographic characteristics and duration

Table 1: Comparison of age and gender distribution (N= number of patients with %ages) (SD= standard deviation)

Group	N			Mean age in years	SD±
	Male	Female	Total		
Sevoflurane	20 (66.7%)	13 (33.3%)	33 (100%)	6.32	2.00945
Halothane	23 (76.7%)	11 (23.3%)	34 (100%)	6.82	2.29052

Table 2: Comparison of weight Distribution & Duration of Surgery

Agent	Weight Distribution			Duration of Surgery	
	No. of patients	Mean weight (kilograms)	Standard Deviation±	Mean Duration (minutes)	Standard Deviation ±
Sevoflurane	33	16.0833	5.33059	47.86	10.368
Halothane	34	16.8333	5.86387	47.13	10.880

Table 3: Comparison of mean induction time

Time (Seconds)	Sevoflurane (No. of patients 33)	Halothane (No. of patients 33)
41-60	10	01
61-80	16	00
81-100	7	12
101-120	00	18
121-140	00	02
>140	00	01
Maximum time (secs)	90 (Case No's 3, 7, 8, 9, 13, 30)	150 secs (case No. 33)
Minimum time (secs)	40 (Case No. 5)	52 secs (case No. 18)
Mean±SD (secs)	96.2±12.7	117.6 secs±13.3 p<0.05

Table 4. Comparison of induction and emergence times

Group	Sevoflurane No. of patients 33		Halothane No. of patients 34		T-value
	Mean	Std deviation	Mean	Std deviation	
Time to loss of eyelash reflex	96.3	11.471	117.466	11.675	t=6.984 P=0.001
Time to obtain constricted pupil in median position (sec)	256.133	21.599	270.170	05.608	T=6.984 P=0.001
Time to obtain constricted pupil in median position (sec)	256.133	21.599	270.170	05.608	T=6.984 P=0.001
Time to intubation (sec)	358.833	21.913	383.666	26.390	T=3.819 P=0.001
time of skin incision (sec)	551.666	45.378	672.500	72.382	T=5.743 P=0.001
Time to extubation (sec)	524.333	87.333	999.666	169.725	T=6.984 P=0.001
Time to emergence (sec)	681.833	91.703	1379.00	195.167	T=6.656 P=0.001
Response to appropriate verbal commands (sec)	1162.16	106.055	2229.16	243.587	T=6.655 P=0.001

of surgery of the two groups is given in Table 1 and 2. Both Tables shows that the groups were statistically comparable. It is time duration from application of face mask till the loss of eye lash reflex. Comparison of mean induction time between the two groups showed a p value of <0.05 which was statistically significant. (Table 3)

Table 4 shows that the mean time to loss of eyelash reflex was significantly faster with Sevoflurane. Similarly time to constrict pupil in median position and time to intubation was early with Sevoflurane compared to halothane. Time to extubation, and emergence and time to age appropriate verbal commands were also significantly faster with Sevoflurane than Halothane.

DISCUSSION

Inhalational induction of anesthesia is one of the most common methods of induction employed in children because of difficulty in securing intravenous line in awake child and the psychological trauma associated with it[7]. Various inhalational agents like Ether, Chloroform, Cyclopropane, Trichloroethylene and Methoxyflurane have been used for induction of anesthesia[8,9]. The search for ideal inhalational anesthetic agent went on so that Halothane came in the practice as it satisfies most of the properties of an ideal inhalational anesthetic agent. It was most commonly used until Sevoflurane was introduced in year 1990. Like halothane, it has low blood gas solubility coefficient allowing rapid induction[10]. Because of its non-pungent odor induction is said to be smooth with this agent. It neither sensitizes the myocardium nor produces myocardial depression. In view of it sevoflurane has gained popularity as inhalational induction agent of choice in children[11]. Even till this day most anesthesiologist use halothane but the main side effects are its tendency to cause arrhythmias and the risk of fulminant hepatitis on many exposures[12]. Sevoflurane is a superior agent with its non-pungent odor and low blood gas solubility factor providing significantly quicker induction and rapid recovery from anesthesia without any airway complications[13].

In this study, sixty seven children aged from 3-12 years old were divided in to two groups of 33 and 34 respectively. They were fasted for six hours premeditated with atropine sulphate 0.02 mg/kg and midazolam 0.1 mg/kg half an hour before shifting to operation room.

In this study the mean time taken to achieve loss of eyelash reflex was considerably shorter with sevoflurane (21 seconds) than halothane similar to that of study by Redhu S, who found that sevoflurane caused loss of eyelash reflex 19 seconds ahead than halothane[14]. Another study by Rukhsana have shown that Sevoflurane produced loss of eyelash reflex 75 seconds faster than Halothane[15]. Sevoflurane due to

its low blood gas solubility coefficient (0.6) compared to halothane is expected to produce faster induction[9,16]. Contrary studies like A. Michalek-sauberer. Concluded that the induction was smooth and the time to loss of eyelash reflex was slightly shorter with sevoflurane than with halothane, but the difference not quite reaching statistical significance (0.06)[17]. Other studies have found no significant difference compared induction times of Sevoflurane and halothane even though methods of induction and timings were similar to this study[11,13]. In a recent study on 100 infants conducted by Hussain Al-Khraysha MD. Sevoflurane, when used for infants undergoing herniotomy produces better induction and more rapid recovery than Halothane[18].

In this study clinical end point (constricted pupil in median position) was achieved quickly with sevoflurane induction (256.1 sec SD 21.6) than Halothane (270.1 SD 23.4) having difference of 14 seconds. Hussain Al-Khraysha MD also achieved end point to complete induction used in our study in similar time[18]. Redu S found mean time to complete induction with Sevoflurane in 222.8 seconds and halothane in 274.48 seconds. Similarly a difference of 12 seconds in the induction time in halothane group was 141 sec $\pm$ 26.3 SD and 129 sec $\pm$ 21.5 SD in Sevoflurane achieved by Hussain Al-Khraysha[14].

There was no significant difference between tracheal intubation in both the groups. The intubating conditions in both the agents were ideal in most of the children, although induction was slightly rapid with sevoflurane. Similar result were observed in study by Redhu S et al[14]. Airway complications were low in both the groups in this study. Doi M and Ikeda K found Sevoflurane least irritant to airway compared to Halothane[19].

In this study both Sevoflurane and Halothane delivered smooth induction, quality of anesthesia and satisfactory hemodynamic effects. However Sevoflurane maintained myocardial contractility and has lesser myocardial depressant action compared to halothane. The recovery in sevoflurane group was significantly faster (681$\pm$91.7) compared to halothane (1379$\pm$195.1). Similar result was found in other studies. Study by Welbornand co-authors LG failed to show this significant difference, wherein time to emergence was found to be similar with halothane and sevoflurane[20]. Their study compared the emergence and recovery characteristics of Sevoflurane, Desflurane and Halothane in 1-7 years children premedicated with midazolam. The reason for similar emergence could be due to lower MAC of halothane was used 0.56% during maintenance of anesthesia compared to 0.90% in this study and other similar studies[21]. Limitations we faced in this study were because of small sample size and unable to blind the study. Also we were unable to perform the study at multiple centers.

CONCLUSION

Induction and intubation is rapid with Sevoflurane compared to Halothane and hemodynamic stability during induction and intubation is better with sevoflurane compared to halothane.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Ilays M: Planning of study, manuscript writing.

Salim S: Data Analysis.

Rehman RU: Data management.

Halimi NN: Statistics.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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