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Evalution of high doses of sevoflurane with progressive doses of sevoflurane for induction of anaesthesia in Paediatric patients

Mohit Roy and Rakesh Modi

Abstract
Introduction: We designed our study to compare high doses of sevoflurane with incremental doses of sevoflurane for induction of anaesthesia in paediatric patients.
Materials and Methods: Patients were subjected to detailed clinical history, complete general physical and systemic examination. Routine investigations like haemoglobin (Hb), bleeding time (BT), clotting time (CT), urine complete examination and any other investigations needed were done.
Results: Time to loss of eyelash reflex and time to complete induction are considerably lesser both clinically and statistically in sevoflurane group. ($p< 0.001$). Emergence from anesthesia ($p< 0.001$) was significantly faster in patients receiving sevoflurane than in halothane. Table No. 2 depicts the same.
Conclusion: Sevoflurane provides clinically acceptable intubating conditions and can be a suitable alternative to propofol-suxamethonium for endotracheal intubation in children.

Keywords: Sevoflurane, induction, pediatric patients

Introduction

The introduction of fluorinated hydrocarbons into clinical practice provides one of the greatest landmarks in the development of anaesthesia. Fluorinated hydrocarbons are used very frequently in paediatric patients as inhalational agents for induction and in adults for day care anaesthesia [2]. Sevoflurane causes less bradycardia and myocardial depression when compared to halothane [2]. This could also have led to reduction in the proportion of cases of inhalation agent-related cardiovascular depression resulting in cardiac arrest in the United States [4]. The introduction of sevoflurane into clinical anaesthetic practice started in Japan in May 1990, and by 1993, one million patients had received it [2]. Since then, its use has superseded the use of halothane for inhalational induction and intubation in paediatric anaesthesia. Several studies have compared intubation in children without the use of muscle relaxants. These studies employed sevoflurane with or without nitrous oxide in oxygen. Others employed use of sevoflurane with opioids and also in combination with propofol and benzodiazepines such as midazolam [4-7]. All these combinations showed comparable conditions with the traditional use of suxamethonium which is thought to provide the optimal condition for tracheal intubation [8-11]. The induction of sleep by inhalation has a tradition in anaesthesia, which encompasses our very roots. Many attribute the beginning of modern anaesthesia to Morton's demonstration of the inhalation of ether in the mid nineteenth century. Almost immediately, the search began for a safe agent, which facilitated inhalation induction, as ether too often produce a prolonged, unpleasant and stormy induction. Introduction of halothane have revolutionized the anaesthetic practice in general and pediatric in particular. Halothane with its negligible pungency and minimum effects on airway reactivity has been the cornerstone of pediatric inhalational induction despite its propensity to cause bradycardia, hypotension and arrhythmias.

Materials and Methods

In this study all the children were examined during the preoperative visit a day prior to surgery. A full explanation of general anaesthesia and about the study, including risks and benefits was given to the guardians and informed written consent was obtained from them. Patients were subjected to detailed clinical history, complete general physical and systemic examination. Routine investigations like haemoglobin (Hb), bleeding time (BT), clotting time (CT), urine complete examination and any other investigations needed were done.

The procedures followed were in accordance with the ethical standards on human experimentation and the study was approved by the ethics committee of our hospital. The parents or guardians of all the patients were explained and written informed consent was taken. The older children were also briefed about the procedure. In this study all the children were examined during the preoperative visit a day prior to surgery. A full explanation of general anaesthesia and about the study, including risks and benefits was given to the guardians and informed written consent was obtained from them.

Results

In our study, most common surgical procedure was cleft lip repair constituting 60% (42 patients) followed by cleft palate repair which constituted 31.4% (22 patients) of all Table No.1

Table 1: Table showing different surgical procedures in two study groups

Procedure	Group I (Halothane)		Group II (Sevoflurane)		Total	
	No.	%	No.	%	No.	%
Cleft lip repair	20	57.1	20	57.1	40	57.1
Contracture Release	0	0	2	5.7	2	2.8
Cleft palate repair	11	31.4	8	22.8	19	27.1
Lymph Node Excision	2	5.7	0	0	2	1.7
Palatal fistula repair	0	0	2	5.7	2	2.8
Tongue tie release	0	0	2	5.7	2	2.8
Tongue Flap	2	5.7	0	0	2	2.8
Urethroplasty	0	0	1	2.8	1	1.4

Time to loss of eyelash reflex and time to complete induction are considerably lesser both clinically and statistically in sevoflurane group. ($p< 0.001$). Emergence from anesthesia ($p< 0.001$) was significantly faster in patients receiving sevoflurane than in halothane. Table No. 4 depicts the same.

Table 2: Comparison of time of Induction and Emergence in two groups (seconds)

S. No.	Parameter	Group I (Halothane)		Group II (Sevoflurane)		Statistical Significance	
		Mean	SD	Mean	SD	"t"	"p"
1.	Time to Loss of eyelash reflex	88.5	17.7	60.3	13.9	8.357	<0.001
2.	Time to Complete Induction	208.2	30.8	173.5	23.1	6.117	<0.001
3.	Emergence Time	340.6	96.5	219.6	4.9	7.245	<0.001

Discussion

Dubois *et al*. compared the three techniques for induction of anesthesia with sevoflurane in children. They studied 65 patients, 23 patients were induced using incremental induction of sevoflurane in 100% oxygen, 22 patients were induced using high concentration of sevoflurane in 100% oxygen and 20 patients were induced with high concentration of sevoflurane in a mixture of oxygen and nitrous oxide (1:1). Induction was well accepted and well tolerated in most children, Similarly in our study also induction was well accepted and well tolerated in patients. Induction time was 85±16 secs in incremental concentration group and was 61±12 secs in high concentration group with 100% oxygen. In our study the mean time for loss of eyelash reflex using high concentration was found to be 60.225 ±4.932 secs and using incremental concentration was found to be 84.9± 6.953secs, which is comparable with the above study. All three techniques were well tolerated in children [12]. In our study we found no significant change from baseline in HR, SBP and DBP in both the groups. The heart rate showed an increasing trend from baseline in both the groups which was maximum just before induction and returned to baseline after insertion of PLMA. This difference was statistically insignificant (p value >0.05). Similar changes in heart rate were also noted in study conducted by Dubois *et al*. [12] We also observed a slight decrease in SBP and DBP in both the groups which was not statistically significant. The SBP reached its lowest point just before induction and returned to baseline 5 mins after insertion of PLMA. In group I, from 102±6.421 mm Hg at baseline to 96.15±6.347 mm Hg at the time of induction and returned to near baseline 5 minutes after insertion of PLMA. In group II, from 102.35±6.241 mm Hg at baseline to 97.675±6.111 mm Hg at the time of induction and returned to near baseline 5 minutes after insertion of PLMA. The lowest reading of DBP in group I was 49.75±3.807 mm Hg, which was seen at the time of induction, whereas the baseline was 54.1±4.505 mm Hg. The lowest reading of DBP in group II was 50.15±4.566 mm Hg, which was seen at the time of induction, whereas the baseline was 54.2±4.456 mm Hg. Epstein *et al*. in 1998 also did not find any statistically significant decrease in systolic and diastolic blood pressure using sevoflurane for induction, this was similar to our study results [13].

Excellent intubating conditions is a score of 3–4, good intubating conditions is a score of 5–6, while 9–12 is considered poor and 13–16 is bad. Excellent and good scores are considered as clinically acceptable, fair and poor scores are considered as clinically unacceptable. Blair *et al*. [4] demonstrated that excellent intubating conditions- which was a score of 1 in each criterion -were achieved in 70% of the propofol suxamethonium group in 45% of the sevoflurane group. In this present study, excellent intubating condition score was seen in 84.8% of patients in propofol-suxamethonium group and 45.5% in sevoflurane group. The excellent intubating conditions were similar in sevoflurane groups of both studies, but lower value of 70% obtained in their propofol-suxamethonium group could be attributed to the lack of analgesics used in their study whereas our patients were given intravenous fentanyl 2 ∝g/kg before intubation in this study. Analgesics, especially opioids, have been shown to deepen anaesthesia and attenuate

laryngopressor response. Excellent intubating conditions were seen in 100% of patients in a study by Kumar *et al*., [14] sevoflurane was used for induction and intubation following apnoea at 4.5min, and then, intravenous propofol 1 mg/kg was administered. Thereafter, laryngoscopy and intubation were done at 5.5min [14]. This high success rate could be attributed to the use of sevoflurane till the patients were apnoeic at 4.5 min and use of propofol which causes apnoea in all their patients. Propofol also causes suppression of pharyngeal and laryngeal reflexes.Excellent conditions are less frequently associated with laryngeal morbidity according to studies done by Mencke *et al*. [15] From their study, they concluded that the quality of tracheal intubation contributes to laryngeal morbidity, and excellent conditions are less frequently associated with post-operative hoarseness and vocal cord sequelae. Adding atracurium to a propofol-fentanyl induction regimen significantly improved the quality of tracheal intubation and decreased post-operative hoarseness and vocal cord sequelae. The difference in immediate post-intubation heart rate was not statistically significant between the two groups. The reduction in heart rate at 1 and 3 min was more in the propofol/suxamethonium group as a result of their pharmacological effect on heart rate. The use of fentanyl and lignocaine could also have contributed to attenuation of laryngopressor response. The immediate post-induction and post-intubation side effects were minimal in this study. However, there was statistically significant difference between the diastolic blood pressure in the sevoflurane group (Group II) and the propofol/suxamethonium group (Group I) with lower post-intubation diastolic blood pressures in Group I. This could be due to the fact that diastolic pressure is a measure of systemic vascular resistance and propofol causes a greater decrease in systemic vascular resistance [16].

Conclusion

Sevoflurane provides clinically acceptable intubating conditions and can be a suitable alternative to propofol-suxamethonium for endotracheal intubation in children. Although sevoflurane is not as effective as propofol-suxamethonium for endotracheal intubation in children, it could be used as an alternative in elective procedures. We recommend the use of sevoflurane to facilitate intubation in elective procedures in children.

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