



TO STUDY AND COMPARE RECOVERY CHARACTERISTICS AND POST EXTUBATION ADVERSE EVENTS OF SEVOFLURANE WITH HALOTHANE FOR INHALATIONAL ANAESTHESIA IN PAEDIATRIC PATIENTS.

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ABSTRACT

When it comes to inhalational anaesthesia in paediatric patients, Sevoflurane, with its non pungent odour, low blood – gas solubility, cardiostable properties and minimal hepatotoxicity takes the advantage over halothane but recovery after sevoflurane anaesthesia is, however associated with a high incidence of agitation and delirium.

We designed this study to compare the recovery characteristics and post extubation adverse events of sevoflurane with halothane anaesthesia in children aged 2 – 10 years undergoing various commonly performed surgical procedures.

Sixty patients, aged between 2 to 10 years undergoing various surgeries were randomly divided into two groups of 30 each to receive either sevoflurane or halothane anaesthesia, induced by using equipotent incremental doses of either of the inhalational agent upto 3 MAC. Anaesthesia was then maintained with either of the inhalational agents at 0.5 MAC with nitrous oxide (60%) in oxygen (40%). At the end of surgery, extubation characteristics and steward recovery score were assessed and compared.

Our study showed a significantly high incidence of postoperative excitement and restlessness during recovery from sevoflurane anaesthesia compared to halothane (43% vs 3.33%) with significantly better steward recovery score at 3 min (25/30 patients in sevoflurane group vs 11/30 patients in halothane group).

KEYWORDS : halothane, sevoflurane, recovery, inhalational, paediatric.

Introduction

Induction and maintenance of general anaesthesia in paediatric patients is often managed with an inhaled anaesthetic agent, which provides rapid and smooth induction and emergence, haemodynamic stability, analgesia and amnesia.

Till today, halothane remains the most frequently used anaesthetic agent for inhalational induction in children because it produces less airway irritation than enflurane, isoflurane or desflurane⁽¹⁾. Despite its efficacy and frequency of use, halothane is not an ideal induction agent because of its potential to cause bradycardia, hypotension and ventricular ectopy^(2,3). The pleasant, non pungent odour of sevoflurane, its low blood – gas solubility along with its cardiostable properties and minimal hepatotoxicity suggests that it has most of the properties of an ideal inhalational agent and that it may be a suitable alternative to halothane for its use in paediatric anaesthesia. Also, it undergoes less and safer metabolism than halothane^(4,5,6,7).

Recovery after sevoflurane anaesthesia is, however associated with a high incidence of agitation and delirium^(8,9). The reason for the more turbulent awakening is unclear but it has been suggested that there is insufficient post operative analgesia when recovery from anaesthesia is fast.

We designed this study to compare the recovery characteristics and post extubation adverse events of sevoflurane with halothane anaesthesia in children aged 2 – 10 years undergoing various commonly performed surgical procedures.

Material and methods

Patients in the age group of 2 – 10 years (ASA grade 1 & 2), undergoing elective paediatric surgeries under general anaesthesia were chosen for the study. Patients with history of any major systemic illness, previous history of hypersensitivity to any anaesthetic drug, patients undergoing emergency surgeries were excluded.

After a careful pre anaesthetic checkup, an informed consent was taken from the guardian of the patient. Premedication with oral midazolam 0.5 mg/kg given 1 hour prior to the procedure. The patients were then randomly divided into two groups to receive

either sevoflurane or halothane anaesthesia.

On reaching the OT table, the baseline values of PR, BP, SpO₂ were recorded. Intravenous access was established. Anaesthesia was then induced with Sevoflurane beginning at 1 MAC (2.5%), increasing by 1% (0.5 MAC) every 3-4 breaths to a maximum of 7.5% (3 MAC) via JR circuit using an appropriate sized face mask along with Nitrous oxide (60%) in oxygen (40%). The same protocol was followed during the induction of anaesthesia by Halothane. There again the induction was started at 1 MAC of Halothane (1%) followed by increments of 0.5% (0.5 MAC) every 3-4 breaths to a maximum of 3% (3 MAC). Once the criteria of induction were met with (loss of eyelash reflex, loss of tone, fixed central pupil, automatic respiration), trachea was intubated with an appropriate sized endotracheal tube and oropharyngeal packing done.

Anaesthesia was maintained with Sevoflurane/Halothane at 0.5 MAC (1.2% and 0.5% respectively) with Nitrous Oxide (60%) in Oxygen (40%). Injection fentanyl 1 µg/kg was given for the intraoperative analgesia. Muscle relaxation was supplemented with inj. Atracurium besylate 0.2 mg/kg as and when required. The top up dose of the neuromuscular blocking agent was timed in such a manner that the last dose was given approximately 20 – 30 mins before the end of surgery.

In both the groups the volatile anaesthetic agent was discontinued at the completion of the last stitch. The neuromuscular block was then reversed after the dressing with inj Neostigmine (0.05 mg/kg) along with inj Glycopyrrolate (0.01 mg/kg). A gentle suction was then done under vision followed by removal of oral packing. The trachea was extubated after the return of the gag reflex, adequate tidal volume, and the return of purposeful movements.

Recovery Score was calculated using the Steward Score along with SPO₂ after reversal of anaesthesia at 1 min, 3 min, 5 min, 10 min, 15 min, for first 15 minutes. Then every 30 mins for the next 2 hours in the recovery room.

STEWARD RECOVERY SCORE:

Consciousness:

Awake

2

Responding to stimuli 1
 Not responding 0

Airway:

Coughing & crying 2
 Maintaining good airway 1
 Airway requires maintenance 0

Movements:

Using limbs purposefully 2
 Non purposeful movements 1
 Not moving 0

SPO2 was recorded every time the scoring was done. Any untoward effects like cough, nausea, vomiting, breath holding, laryngospasm, bronchospasm, excitement or restlessness were noted.

The results were compiled and analysed using the following tests:

Student's T test: Demographic profile, recovery time.
Chi square test : Sex ratio, Untoward effects during recovery, Recovery at 3 mins post extubation, Post op analgesia requirement.

Results

TABLE 1 DEMOGRAPHIC PROFILE

	Group H (n = 30)	Group S (n = 30)	P value**
Age (years)*	5.7 ± 21	4.8 ± 3	0.725
Sex (M/F)	20/10	21/9	1
Wt.(kg)*	15.5 ± 3.33	15.2 ± 3.18	0.865
Surgical procedure			
Upper abd. Surgery	18	21	
Tonsillectomy	5	2	
Orthopaedic surgery	7	7	
Mean duration of anaesthesia(min)			
Upper abd surgery	66.71 ± 13.89	75 ± 7.07	0.465
Tonsillectomy	48.27 ± 7.78	48 ± 10.17	0.098
Orthopaedic surgery	60.17 ± 22.4	59.28 ± 25.9	0.125

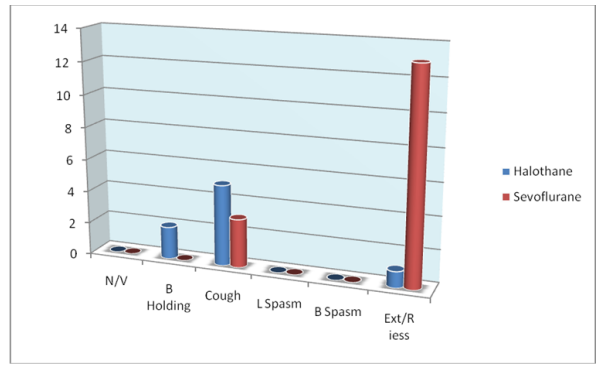
There was no statistical difference between the two groups with respect to the demographic profile, the number of various surgical procedures done and the mean duration of anaesthesia for various procedures. (Table 1)

TABLE 2

UNTOWARD EFFECTS DURING RECOVERY

Parameter	Group H(n=30)	%	Group S (n=30)	%	P Value*
N/V	0		0		
Breath holding	2	6.66	0		0.492
Cough	5	16.66	3	10	0.706
Laryngospasm	0		0		
Bronchospasm	0		0		
Excitement/Restlessness	1	3.33	13	43.33	<0.0001

Halothane had a higher incidence of cough (5 pts) and breath holding (2 pts.) compared to sevoflurane (3 & 0 pts.respectively) but this was statistically insignificant. Sevoflurane had higher chances of excitement and restlessness (13 pts.) compared to halothane (1 patient) and this was found to be very highly significant statistically (Table 2 & fig 1).



RECOVERY UNTOWARD EFFECTS

TABLE 3 RECOVERY SCORE AT 3 MINUTES POST EXTUBATION

SCORE	Group S (n = 30)	%	Group H (n = 30)	%	P Value*
6	25	83.33	11	36.66	0.0006
5	2	6.66	3	10	1
4	1	3.33	8	26.66	0.025
3	2	6.66	3	10	1
2	0		3	10	0.238
1	0		2	6.66	0.491

A perfect Steward recovery score of 6 was found in 25/30 patients in sevoflurane group compared to 11/30 in halothane group. This was statistically very highly significant. The number of patients who still had recovery score of = 4 at 3 mins post extubation were only 3 in sevoflurane group as compared to 16 in halothane group. This difference was also statistically highly significant (Table 3).

SPO2 was maintained throughout the procedure in both the groups. Similarly, ECG did not reveal any conduction abnormalities.

Discussion

We conducted this study to compare the recovery characteristics of sevoflurane and halothane anaesthesia in 60 patients of ASA grade 1 & 2 undergoing various surgeries. We also compared and analyzed any untoward effects during recovery.

Both the groups studied were comparable with respect to the age , sex ratio, weight in kgs, the no. of various surgical procedures done and the mean duration of anaesthesia during the various surgical procedures. [Table 1].

A perfect Steward Recovery score of 6 was found in 25 patients in sevoflurane group at 3 minutes post extubation compared to 11 patients in halothane group [Table 3]. These results are statistically very highly significant. This shows that sevoflurane anaesthesia leads to an early recovery of consciousness , protective airway reflexes and the maintenance of airway. These results are in accordance with the results seen by H. Vittanen et al⁽¹⁰⁾ , A.Beskow et al⁽¹¹⁾ , Leila G Wellborn et al⁽¹²⁾ and V.Piat et al⁽¹³⁾ who found an early recovery with sevoflurane using the Steward Recovery score for analysis.

In our study we observed a significantly high incidence of post operative excitement and restlessness in sevoflurane group (13/30) compared to halothane group (1/30) [Table 2]. The other complications were statistically insignificant in both the groups in our study. Our results are different from Leila J Wellborn et al⁽¹²⁾ who observed no difference in the number of patients having agitation in the sevoflurane group and the halothane group. They attributed this to the short duration of surgery which was not associated with much pain. A.Black et al⁽¹⁴⁾ ,concluded that though the incidence of post operative agitation was higher in sevoflurane group, it was statistically insignificant (P>0.05). G.P.Johannasson et al⁽¹⁵⁾ observed that post operative excitement was more common in sevoflurane

group than in halothane group, when the paracetamol was given rectally in the post operative room. This incidence showed a prompt reduction when paracetamol was given orally at the time of pre medication. They concluded that the difference in the incidence of post operative excitement is eliminated when post operative analgesic treatment is administered prior to anaesthesia allowing appropriate time for the drug to exert its effect. Peter J. Davis⁽⁹⁾ found in his study that in the patients who received intraoperative analgesics (opioids and / or caudal regional blocks), the incidence of emergence delirium was similar for halothane and sevoflurane group. Thus, he concluded that analgesia or lack of it may be a significant factor in emergence delirium. These results are not in concordance with our results where even after equal amount of intra operative analgesia, a higher incidence of excitement and restlessness was observed in patients of sevoflurane group. Our results are in accordance with the studies done by Y. Naito et al⁽¹⁶⁾, Joel B. Sarnier et al⁽⁵⁾, A. Beskow⁽¹¹⁾ and H. Vittanen⁽¹⁰⁾, who all found a higher incidence of post operative excitement and restlessness during their studies.

H. Vittanen et al⁽¹⁰⁾ found a higher incidence of post operative vomiting in his patients in halothane group compared to sevoflurane ($P = < 0.05$), whereas it was not seen in any of our patients.

SPO2 was maintained throughout the procedure in both the groups. Similarly, ECG did not reveal any conduction abnormalities.

Conclusion

From our study, we conclude that recovery from sevoflurane anaesthesia was much faster than with halothane anaesthesia. However, it was associated with a higher incidence of post operative excitement and restlessness. Further studies need to be done to evaluate the exact cause and remedy of excitement and restlessness. We did not find any significant incidence of cardiac arrhythmias with either of the agents.

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