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.

We studied 30 patients in each group. In the sevoflurane group the last dose was given approximately 20 – 30 mins after the end of surgery. In the halothane group, the last dose was given when the MAC was 1% (0.5 MAC). 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. Then 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 blocking block was then reversed after the dressing with inj. Neostigmine (0.05 mg/kg) along with inj Glycopyrolate (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

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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

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

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group H (n = 30)</th>
<th>Group S (n = 30)</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/V</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Breath holding</td>
<td>2</td>
<td>6.66</td>
<td>0.492</td>
</tr>
<tr>
<td>Cough</td>
<td>5</td>
<td>16.66</td>
<td>3</td>
</tr>
<tr>
<td>Laryngospasm</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Bronchospasm</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Excitement/Restlessness</td>
<td>1</td>
<td>3.33</td>
<td>13</td>
</tr>
</tbody>
</table>

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).

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).

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[8], A. Beskow et al[9], Leila G Wellborn et al[12] and V.Piat et al[16] who found an early recovery with sevoflurane using the Steward Recovery score for analysis.

In our study we observed a significantly high incidence of postoperative 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[16] 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[16] concluded that though the incidence of post operative agitation was higher in sevoflurane group, it was statistically insignificant (P>0.05). G.P. Johannsson et al[16] 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 premedication. 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. Sarner et al\(^{15}\), 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\(^{11}\) 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.

**REFERENCES**

12. Leila G Welborn, Raafat S Hannallah. Comparison of emergence and recovery characteristics of sevoflurane, desflurane and halothane in pediatric ambulatory patients. Anesth Analg 1996;83:917-20