A Comparative Study of Desflurane and Sevoflurane for Hemodynamic ability and Postoperative outcome under General Anesthesia

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ABSTRACT:
BACKGROUND: Comparison of Desflurane and Sevoflurane for hemodynamic stability intraoperative and postoperative outcome in patients under general anesthesia. MATERIAL & METHODS: 40 patients aging 25-55 years were selected for elective surgery under general anesthesia. After premedication, preoxygenation was done for 3 minutes and induced with Inj. Propofol 2 mg/kg, relaxed with Inj. Scholine 1-2 mg/kg for intubation. Tube was fixed after checking bilateral air entry. Anesthesia was maintained in the two groups using oxygen-nitrous oxide along with sevoflurane (Group S n=20) or desflurane (Group D n=20) as per end tidal concentration. Neurmuscular blockade was maintained with Inj. Atracurium infusion at 0.4 mg/kg/hr. Continuous monitoring of HR, SPO2, Blood pressure, PNS, EtCO2 & End tidal conc. of Inhalational agent was done. At the end of the surgery patient was reversed conventionally. Recovery was assessed by recording the response to painful stimuli and verbal commands, spontaneous eye opening and Limb lift and modified Aldrete Score on arrival in recovery room, 5 min and 10 minutes. RESULTS: Intraoperative hemodynamic parameters did not differ in the two groups. After discontinuation of volatile anesthetic, the time to recovery parameters like reaction to painful stimuli, obeying verbal commands and spontaneous eye opening was significantly shorter in patients with Desflurane ( P <0.001). The modified Aldrete Score was comparable between the two groups. CONCLUSION: Both desflurane and sevoflurane produce similar hemodynamic changes but the immediate and intermediate recovery was significantly faster after desflurane thus contributing to fast tracking and early discharge of patients.

Keywords: Desflurane, Sevoflurane, general anesthesia, modified alderete score.

INTRODUCTION
• Favorable emergence and recovery profiles of newer volatile anesthetics have made their use increasingly common. Inhaled volatile anesthetics
  - Ease of administration
  - Predictable intraoperative and recovery characteristics.
• Because of the low blood-gas partition coefficients of Sevoflurane (0.69) and Desflurane (0.42) rapid emergence compared to traditional inhalation anesthetics¹
• The more rapid awakening may contribute to a decrease in the period of time that the patient’s airway is left unprotected²
• Desflurane - Fluorinated methyl ethyl ether differs from isoflurane by just one atom: a fluorine atom on the Ïethyl component of isoflurane.
• Desflurane requires an electrically heated, pressurized vaporizer because of Desflurane’s unique physical properties.
• Completely fluorinating the ether molecule has several effects.
• - It decreases blood and tissue solubility
  - (The MAC of Desflurane is five times higher than Isoflurane)³
• Sevoflurane - Highly fluorinated methyl isopropyl ether, name derives from having its from having seven fluorine atoms in its substituents.⁴
• Sweet-smelling gas, Can be used in a conventional vaporizer.³
• The blood gas solubility of Sevoflurane is second only to Desflurane
• Sevoflurane is approximately half as potent as Isoflurane

Aims And Objectives
• Aims- To compare the hemodynamic and recovery characteristics of Sevoflurane with those of Desflurane in general anesthesia
• Objectives- To Compare hemodynamic parameters

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After approval from ethical committee and written informed consent 40 patients were selected for elective surgery under general anesthesia.

### MATERIAL AND METHODS

### INCLUSION CRITERIA

- Patients age 20-60 years
- ASA Grade I, II, III
- Patients undergoing surgeries under GA lasting from 45 min up to 2 hours

### EXCLUSION CRITERIA

- Patients with clinically significant
- Cardiovascular
- Respiratory
- Hepatic, renal,
- Neurological,
- Psychiatric and Metabolic disease
- Any h/o Malignant hyperthermia
- Patients having weight double to ideal body weight.
- Patients with h/o alcohol consumption.

Patients were equally divided in to two groups

<table>
<thead>
<tr>
<th>Group-S</th>
<th>Group-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEVOFLURANE</td>
<td>DESFLURANE</td>
</tr>
</tbody>
</table>

A pre-anesthetic check up was done in all patients which included a detailed History, General, Systemic Examination and Routine Investigations.

### Premedication

- Inj.Glycopyrolate 0.2mg IV
- Inj.Emset 4mg IV
- Inj.Midaz 1mg IV

### Monitoring

- Pulse
- NIBP
- SPO2
- ECG
- ETCO2
- Temperature
- PNS

### Induction

- Inj. Fentanyl 1mcg/kg
- Inj. Propofol 2 mg/kg
- Inj. Scholine 1-2 mg/kg IV for intubation

### Maintenance

<table>
<thead>
<tr>
<th>O2</th>
<th>N2O</th>
</tr>
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<tbody>
<tr>
<td>50%</td>
<td>50%</td>
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</table>

**SEVOFLURANE 1% - 2%**

<table>
<thead>
<tr>
<th>O2</th>
<th>N2O</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>50%</td>
</tr>
</tbody>
</table>

**DESFLURANE 3% - 6%**

**Muscle relaxant** – Vecuronium 0.1mg/kg was given and maintenance dose – Determined to visible one twitch response to TOF

- Patient was maintained with control ventilation fresh gas flow 3lit/min in semi closed circuit.

**Concentration** of inhalation agent was adjusted to keep Pulse, BP within 20% of base line value

- Inj. Fentanyl 0.5mcg/kg – to control acute hemodynamic changes not responding to 50% rise in inspired concentration of volatile agent

**Nitrous oxide And inhalation agent** were discontinued at the last skin suture.

- Time of discontinuation of inhalation agent was noted.

### Reversal

- Inj.Neostigmin 2.5 mg and Glycopyrolate 0.4mg IV
- The trachea was extubated when a regular spontaneous breathing pattern was reestablished
- Time of Extubation was noted.

### Recovery assessed by -

- Response to painful stimuli
- Verbal commands,
- Spontaneous eye opening
- Limb lift

Modified Aldrete Score on arrival in recovery room, 5 min and 10 minutes.

### The ‘Modified’ Aldrete Scale

<table>
<thead>
<tr>
<th>Respiration</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to take deep breath and cough</td>
<td>Dyspnea / Shallow breathing</td>
<td>Apnea</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>O2 Saturat</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintains &gt; 92% on room air</td>
<td>Needs O2 to maintain O2 Saturation &gt; 90%</td>
<td>Saturation &lt;90% even with supplemental O2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consciousness</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibly awake</td>
<td>Arosable on Calling</td>
<td>Not responding</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Circulation</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP=20mmHg pre op</td>
<td>BP=20-50mmHg pre op</td>
<td>BP=50mmHg pre op</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activity</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to move 4 extremities voluntarily or</td>
<td>Able to move 2 extremities</td>
<td>Able to move 0 extremities voluntarily or</td>
<td></td>
</tr>
</tbody>
</table>
Parameters to be measured
- Heart rate every 15 min
- MAP every 15 min
- Total dose of Fentanyl and Vecuronium
- Time of extubation
- Opening of eyes
- Response to verbal command
- Stating name
- Squeezing fingers (hand grip)
- Aldrete score accordingly for 5min and 10 min

RESULTS
Table1 showing the distribution of demographic characteristics among the two groups. The two study groups were comparable with respect to gender, age, weight and the duration of anesthesia.

Intra operative hemodynamic parameters did not differ in the two groups during the course of anesthesia and were successfully Maintained within 20% of baseline values with both anesthetics.

Changes in intra operative hemodynamic parameter (a) Mean arterial pressure, (b) Heart rate. Result are presented as mean ± SD. P < 0.005
The table shows the total dose of Fentanyl and Vecuronium used in two groups

<table>
<thead>
<tr>
<th></th>
<th>Sevoflurane Group-S</th>
<th>Desflurane Group-D</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fentanyl Required(Mcg)</td>
<td>72.2 ± 5.6</td>
<td>75.3 ± 6.2</td>
<td>0.04</td>
</tr>
<tr>
<td>Total Vecuronium Required(Mg)</td>
<td>7.3 ± 1.4</td>
<td>7.6 ± 1.7</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Early and Intermediate Recovery

In response to Pain, Verbal commands, Eye opening, Stating name, Squeezing fingers and Aldrete scor

<table>
<thead>
<tr>
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<th>Desflurane</th>
<th>Sevoflurane</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response to painful stimuli (min)</td>
<td>3.02 ± 2.0</td>
<td>6.75 ± 4.200</td>
<td>0.000</td>
</tr>
<tr>
<td>Response to verbal commands (min)</td>
<td>3.45 ± 2.1</td>
<td>7.45 ± 4.540</td>
<td>0.001</td>
</tr>
<tr>
<td>Spontaneous eye opening (min)</td>
<td>3.75 ± 2.3</td>
<td>8.50 ± 5.708</td>
<td>0.001</td>
</tr>
<tr>
<td>Stating Name (min)</td>
<td>4.56 ± 6.0</td>
<td>10.8 ± 6.780</td>
<td>0.059</td>
</tr>
<tr>
<td>Squeezing finger</td>
<td>5.28 ± 7.5</td>
<td>12.3 ± 7.116</td>
<td>0.088</td>
</tr>
</tbody>
</table>

Modified Aldrete Score

<table>
<thead>
<tr>
<th></th>
<th>Arrival</th>
<th>After 5 min</th>
<th>After 10 min</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7.55 ± 1.460</td>
<td>8.80 ± 1.152</td>
<td>9.60 ± 0.598</td>
</tr>
<tr>
<td></td>
<td>7.15 ± 1.268</td>
<td>8.05 ± 1.276</td>
<td>9.05 ± 1.050</td>
</tr>
</tbody>
</table>

DISCUSSION
- Early recovery (emergence) more rapid after Desflurane compared to Sevoflurane
- Similar result by Fraizer et al for maintenance of outpatient anaesthesia in children
- Result of Nathanson et al and S.Gerin et al also proved rapid early recovery with desflurane.
- All these studies found no difference in late recovery
- Song et al showed regardless of duration of anaesthesia, elimination was faster and recovery was quicker for Desflurane than Sevoflurane
- Intraoperative cardio vascular stability was easily achieved with both
- Some studies have mentioned decrease HR below baseline after induction was less with desflurane due to sympathetic stimulation
- Contrast to other studies Our study has not recorded tachycardia after sudden increase in the inspired concentration of desflurane

CONCLUSION
Sevoflurane and Desflurane provided similar intraoperative condition during maintenance period but early recovery was more rapid with Desflurane compared to Sevoflurane

REFERENCES
1. Nathanson MH, Fredman B, Smith I, White PF. Sevoflurane versus desflurane for outpatient anaesthesia:


