Low Flow Anesthesia in Pediatric Patients

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- 5% of the hospital carbon footprint is attributed to volatile anesthetic agents which are potent greenhouse gases. Utilizing low flow anesthesia is one of the most impactful sustainability efforts as an individual anesthesia provider.
- Low flow anesthesia can be applied throughout the anesthetic. Strategies for safely reducing flows during induction and maintenance are described.

### Easy method to achieve minimum safe fresh gas flow:

<table>
<thead>
<tr>
<th>Induction</th>
<th>Maintenance</th>
<th>Hint:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20kg</td>
<td>&lt;50kg, use ≤ 500ml/min</td>
<td>50kg/50:50/500ml</td>
</tr>
<tr>
<td>20-30kg</td>
<td>50% O₂, 50% Air mixture</td>
<td>Always use ≤1 lpm</td>
</tr>
<tr>
<td>30-40kg</td>
<td>≥50kg, use ≤1 lpm</td>
<td></td>
</tr>
<tr>
<td>&gt;40kg</td>
<td>6 lpm</td>
<td></td>
</tr>
</tbody>
</table>

### Complex method to achieve minimum safe flow:

#### Induction:
- Set FGF to exceed minute ventilation ($V_E$) to create open circuit condition: 150 mL x weight (kg) ($V_E$~120 ml/kg estimate based upon VCO₂ from Brody’s equation)
- GOAL: Acceptable time to complete induction. Priming the circuit can speed up induction, but can be wasteful

#### Maintenance:
- Calculate the patient’s O₂ consumption (5 ml/kg/min)¹
- Account for gas analyzer sample volume* (200 ml/min) and leaks (100 ml/min)
- Minimum FGF = O₂ consumption + leak + gas analyzer volume
- Utilize Low Flow Wizard (Drager) & EcoFlow (GE)

Sevoflurane – FGF less than 1 liter per minute is safe and recommended to minimize waste. Newer absorbents do not generate compound A and there is no evidence in humans of renal dysfunction after Sevoflurane exposure.²³.

### Safety Considerations
- Monitor inspired oxygen and end-tidal agent concentrations to avoid hypoxic gas mixtures and inadequate anesthesia.
- Set lower limit alarms for inspired oxygen and end-tidal agent concentrations
- Vaporizer dial may need to be at a higher setting to reach a certain MAC.

* Certain Drager models allow analyzer sample gas to return to circuit- check your machine manual.

### Resources:
- Practice green health.org Anesthetic Gas How-to Guide; ASA Greening the O.R. Manual

### References:

Picture Courtesy: Diane Gordon, MD