

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:

Induction:

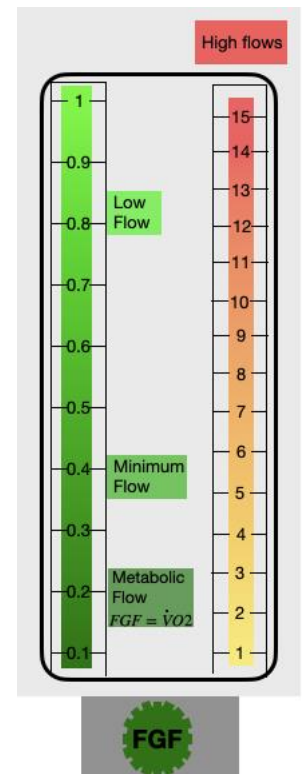
<20kg	3 lpm
20-30kg	4 lpm
30-40kg	5 lpm
>40kg	6 lpm



Maintenance:

<50kg, use ≤ 500ml/min 50% O ₂ : 50% Air mixture	50kg/50:50/500ml
≥50kg, use ≤1 lpm	Always use ≤1 lpm

Hint:



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) ($V_E \sim 120$ ml/kg estimate based upon V_{CO_2} 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.^{2,3}

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:

1. Feldman JM: Managing fresh gas flow to reduce environmental contamination. Anesth Analg 2012; 114: 1093-101
2. Kennedy RR, Hendrickx JF, Feldman JM: There are no dragons: Low-flow anaesthesia with sevoflurane is safe. Anaesth Intensive Care 2019; 47: 223-225
3. Sondekoppam, R.V., Narsingani, K.H., Schimmel, T.A. et al. The impact of sevoflurane anesthesia on postoperative renal function: a systematic review and meta-analysis of randomized-controlled trials. Can J Anesth 2020; 67, 1595–1623.

Picture Courtesy: Diane Gordon, MD