

Comparison of Absorption of Volatile Anesthetic Agents by Three Different Carbon Dioxide Absorbents

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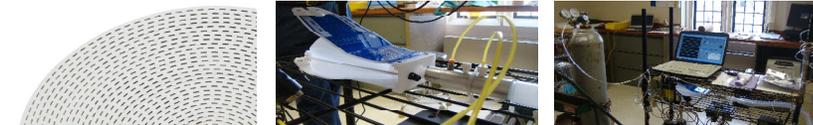
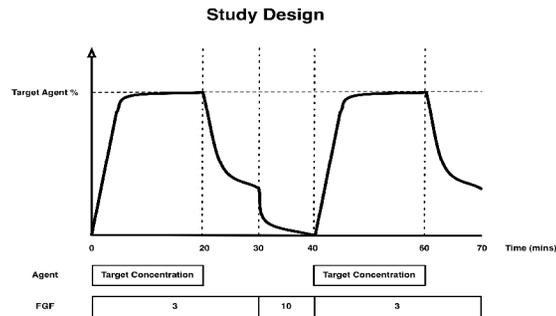
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Introduction

CO₂ absorbents are used throughout the world to reduce consumption of volatile anesthetic agents by permitting the safe use of circle breathing systems. We hypothesized that a novel absorbent based on lithium hydroxide chemistry, ExtendAir®Lithium, would be associated with less anesthetic adsorption and thus lead to faster breathing system equilibration times. We tested this hypothesis by comparing the behavior of three different carbon dioxide absorbents when exposed to three different volatile anesthetic agents.

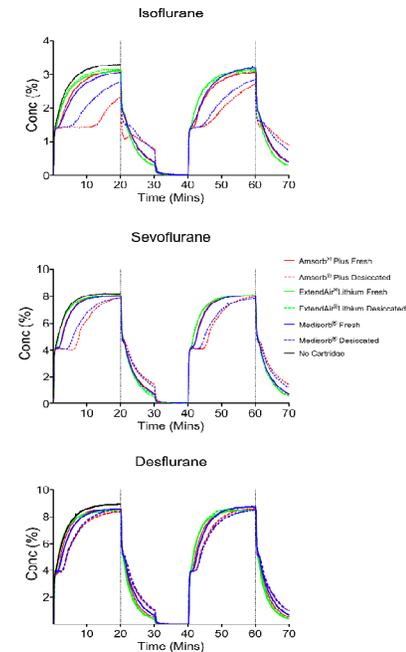
Methods

A test breathing system was constructed using a Datex-Ohmeda Aestiva/5 anesthesia machine and a circle breathing circuit attached to a Linear Test Lung (Ingmar Medical). Ventilation was maintained at a tidal volume of 600 mL with a rate of 12 breaths/min. CO₂ was added to the circuit at a flow rate of 200 mL/min. In separate experiments, vaporizers were set to deliver either desflurane 9%, isoflurane 3%, or sevoflurane 8%. The fresh gas flow (FGF) remained at 3 L/min for both 20 min wash-in phases, but was increased to 10 L/min during the wash-out phase (30 to 40 mins). Three absorbents were studied: Amsorb® Plus, Medisorb® and ExtendAir®Lithium. Absorbents were considered either fresh (unopened manufacturer's packaging) or desiccated (sealed in foil bags following 72 hours exposure to constant gas flow), and were taken out of the packaging or foil bag immediately prior to insertion into the anesthesia machine canisters. A new breathing circuit was used for each experiment. Volatile agent concentration was measured with a calibrated Datex Ultima and recorded at 1 Hz (LabView).



Results

Fig 2 shows the wash-in/wash-out curves for all three agents and all three CO₂ absorbents in both hydration states. All agents reached equilibrium within 20 mins (i.e. the target concentration) except isoflurane with desiccated Medisorb® and desiccated Amsorb® Plus. The second wash-in curves were not different from the first wash-in curves. These data suggest that the CO₂ absorbents in common clinical use are not the same with respect to volatile agent adsorption. In particular, ExtendAir®Lithium was associated with the least adsorption and this was unaffected by hydration state. For the other two absorbents adsorption was agent dependent (ISO > SEVO > DES) and was greater with desiccated form.



Conclusions

Of the three CO₂ absorbents tested, only ExtendAir®Lithium demonstrated no reduction in volatile agent concentration, independent of hydration state (fresh or desiccated). These data may have economic implications for anesthesia practices characterized by many short cases, since the consumption of volatile agent is significantly affected by the type, and hydration state, of the absorbent.

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