

Comparison of Temperature Changes of Three CO₂ Absorbents When Exposed to Three Volatile Agents

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Introduction

Carbon dioxide absorbents are used in circle breathing systems, and their chemical composition is a hydroxide salt, typically calcium, sodium and/or potassium. Lithium hydroxide has previously been examined but was noted to produce a marked exothermic reaction precluding clinical use. ExtendAir®Lithium is a novel lithium hydroxide absorbent wherein the lithium is pre-hydrated to form monohydrate. We hypothesized that ExtendAir®Lithium would be associated with temperature changes comparable to commercially available calcium absorbents. We tested this hypothesis by comparing the temperature changes of three different carbon dioxide absorbents when exposed to three different volatile anesthetic agents.

Methods

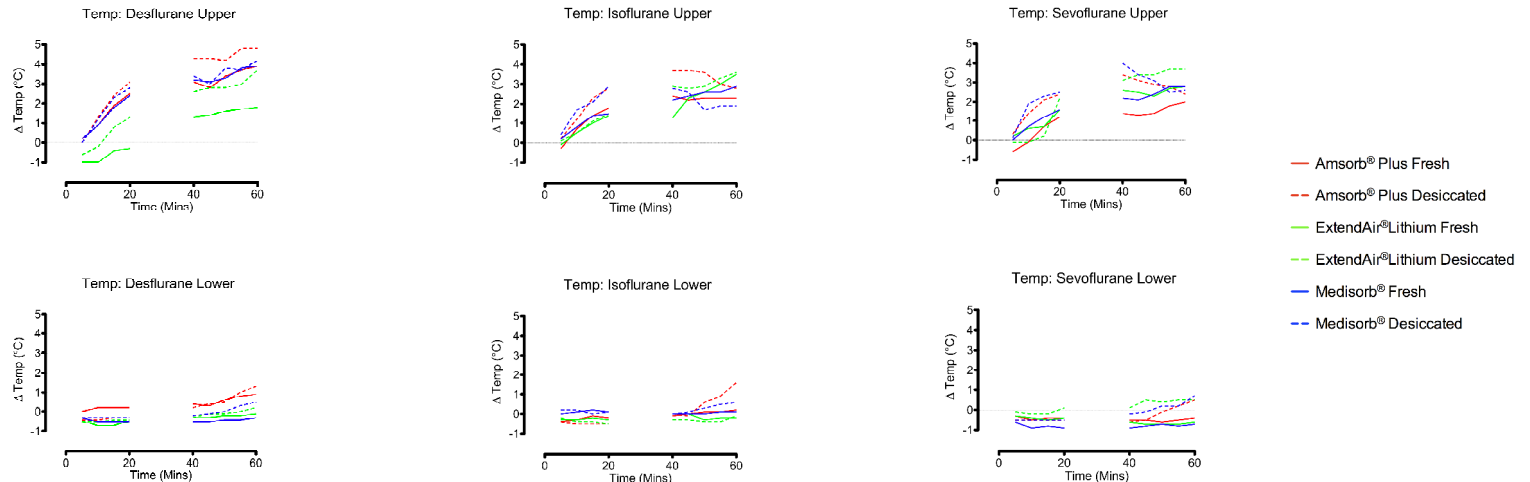
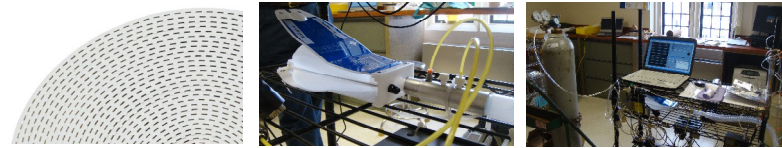
A test breathing system was constructed using a Datex-Ohmeda Aestiva/5 anesthesia machine and a circle breathing circuit attached to a Linear Test Lung (Ingmar Medical). Ventilation was maintained at a tidal volume of 600 mL with a rate of 12 breaths/min. CO₂ was added to the circuit at a flow rate of 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. The surface temperature of the upper and lower canister was measured using IR200 Thermometer (Extech) and recorded at 5 minute intervals.

Results

The figures show the temperature changes (from baseline) for all three agents and all three CO₂ absorbents in both hydration states (fresh and desiccated). The upper canisters showed a greater change in temperature than the lower canisters for all volatile agents. The second wash-in phase showed a further change in temperature, particularly in the upper canisters, for all volatile agents. In general, the hydration state of the absorbent did have an influence upon the temperature change. The desiccated absorbents showed higher temperature changes than the corresponding fresh absorbent with all volatile agents. The temperature change was more pronounced in the upper than the lower canisters.

Conclusions

Of the three CO₂ absorbents tested, all demonstrated canister surface temperature changes of a similar magnitude. These data suggest that the novel formulation of lithium hydroxide, ExtendAir®Lithium, is compatible for clinical use.



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