Comparison of Compound A Production by Three Different Carbon Dioxide Absorbents

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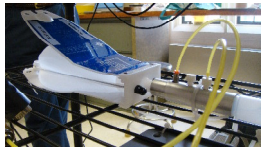
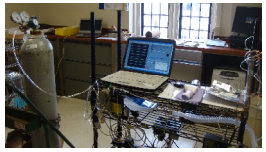
Introduction

Compound A is a vinyl ether produced by the interaction between sevoflurane and strong alkalis, principally potassium and sodium hydroxides commonly found in CO_2 absorbents. We hypothesized that a novel absorbent based upon lithium hydroxide (ExtendAir®Lithium) would produce insignificant amounts of compound A when exposed to sevoflurane. We tested this hypothesis by comparing the compound A production of three different carbon dioxide absorbents when exposed to sevoflurane.

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. CO_2 was added to the circuit at a flow rate of 200 mL/min. In separate experiments, the sevoflurane vaporizer was set to deliver 0.5, 1 or 3 MAC. The fresh gas flow (FGF) remained at 3 L/min for 5 mins then reduced to 1 L/min for a further 55 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. Samples for gas analysis were drawn at the following times: baseline, 15, 30, 45 & 60 mins. Samples were analyzed for compound A using a gas chromatographic mass spectrometer.





Sevoflurane 0.5 MAC

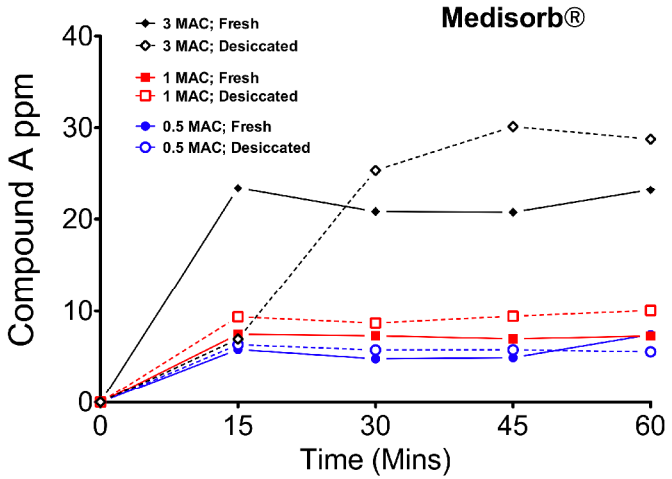
Absorbent	State	Time (mins) 0	15	30	45	60
Amsorb® Plus	F	<1	<1	<1	<1	<1
Amsorb® Plus	D	<1	<1	<1	<1	<1
ExtendAir®Lithium	F	<1	<1	<1	<1	<1
ExtendAir®Lithium	D	<1	<1	<1	<1	<1
Medisorb®	F	<1	5.8	4.8	4.9	7.4
Medisorb®	D	<1	6.3	5.8	5.8	5.6

Sevoflurane 1.0 MAC

Absorbent	State	Time (mins) 0	15	30	45	60
Amsorb® Plus	F	<1	<1	<1	<1	<1
Amsorb® Plus	D	<1	<1	<1	<1	<1
ExtendAir®Lithium	F	<1	<1	<1	<1	<1
ExtendAir®Lithium	D	<1	<1	<1	<1	<1
Medisorb®	F	<1	7.5	7.3	7.0	7.3
Medisorb®	D	<1	9.4	8.7	9.4	10.1

Sevoflurane 3.0 MAC

Absorbent	State	Time (mins) 0	15	30	45	60
Amsorb® Plus	F	<1	<1	<1	<1	<1
Amsorb® Plus	D	<1	<1	<1	<1	<1
ExtendAir®Lithium	F	<1	<1	<1	<1	<1
ExtendAir®Lithium	D	<1	1.4	1.3	1.4	1.5
Medisorb®	F	<1	23.4	20.8	20.7	23.2
Medisorb®	D	<1	6.9	25.4	30.1	26.8



Results

The production of compound A by Amsorb® Plus and ExtendAir®Lithium was negligible (< 2 ppm in all cases). Fig 1 shows compound A production by Medisorb®.

Conclusions

The newer absorbents did not produce compound A at clinically relevant doses. Medisorb®, in contrast, did produce significant amounts of compound A, especially at increasing MAC and when desiccated.