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CORRESPONDENCE

Can Amsorb Plus® reduce the consumption of sevoflurane?

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To the Editor,

The effects of climate change pose one of the biggest public health threats in the 21st century.[1] Paradoxically, the healthcare sector itself is responsible for approximately 8% of global greenhouse gas (GHG) emissions.[2] Volatile anesthetics, such as sevoflurane, are potent GHGs and it is estimated that the global annual emission of anesthetics into the atmosphere account for 3.1 million ton CO_2 equivalent.[3] Therefore, strategies to reduce their consumption can immediately help to reduce the environmental impact of general anesthesia.

Ventilator systems contain CO_2-absorbers to prevent rebreathing. In traditional soda lime type absorbers, CO_2 capture is facilitated by strong bases. Nevertheless, these also react with sevoflurane in the system, forming compound A to E, of which compound A is potentially nephrotoxic.[4] To minimize the concentration of compound A, various national drug-regulating authorities (including in Canada, Australia, and the USA) issued that a fresh gas flow (FGF) greater than 1.0 to 2.0 L·min^{-1} should be maintained during sevoflurane anesthesia with soda lime type absorbers. Because clinical relevance of nephrotoxicity is lacking, no minimal FGF is required in Europe and lower FGFs are employed regularly. The novel CO_2-absorber Amsorb Plus® (Armstrong Medical, Coleraine, UK) lacks strong bases and does not react with anesthetics.[5] Therefore, higher concentrations of sevoflurane will return to the breathing circuit.[4] We hypothesized that application of this novel CO_2-absorber may lower sevoflurane consumption by reducing scavenging from the system as well as allowing low FGFs to be employed.

We performed a randomized prospective crossover study. Ethical approval was waived by the institutional ethics committee (ref: W20_025, Amsterdam UMC, May 2020). Thirty-eight adult patients with an American Society of Anesthesiologists Physical Status of I-III, median [interquartile range (IQR)] age 53 [42-62] yr, weight 81 [69-95] kg, height 175 [166-182] cm, undergoing surgery under sevoflurane-based anesthesia at an end-tidal concentration of 1.0 minimum alveolar concentration corrected for age, were included after consent. Following induction, sevoflurane consumption was measured with a soda lime absorber (Medisorb™ Multi-Absorber Original, CareFusion, Helsinki, Finland) or an Amsorb Plus® absorber in the system. With each absorber, we compared two 30-min bouts at an FGF of 2.0 and 0.5 L·min^{-1}. The measurement sequence was randomized using a computerized algorithm (Castor EDC release 2020.1.18, Castor, Amsterdam, the Netherlands). Before and after each setting, the sevoflurane canister was removed from the anesthesia machine and weighed on a precision scale (PG3001-s, Mettler-Toledo B.V., Tiel, the Netherlands). Sevoflurane consumption was calculated by dividing the difference in canister mass by sevoflurane density (1.22 g·mL^{-1}). Ventilator settings remained unchanged during the experiments. Sample size was calculated before the study started. With a mean

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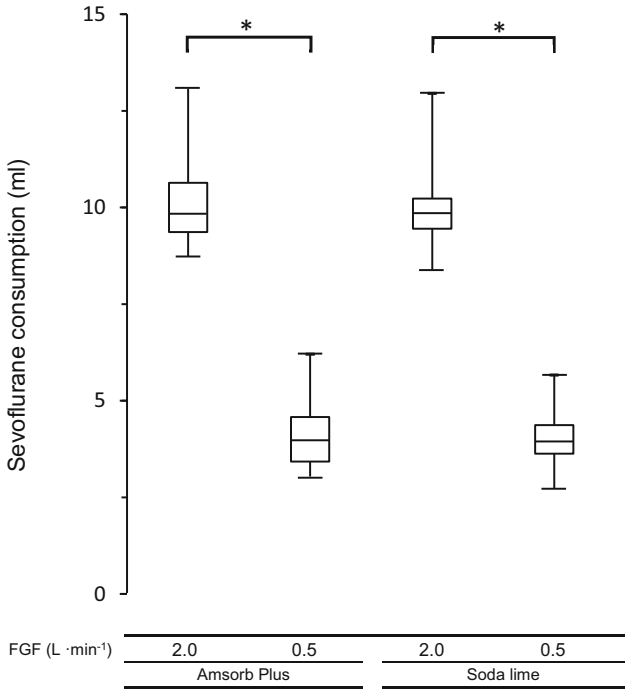

Figure Sevoflurane consumption with different carbon dioxide absorbers and fresh gas flow (FGF) settings presented as median with interquartile range and 95% confidence intervals. *$P < 0.017$.

(standard deviation) estimated sevoflurane consumption of 12.5 (2) mL·30 min^{-1}, a sample size of 38 patients would be sufficient to show a 10% reduction in consumption, accepting a power of 90% and a significance level of 0.017 (Bonferroni corrected *P* value, paired two-sided *t* test). Data were group averaged and tested for significance using Wilcoxon signed rank test. Values are presented as median [IQR].

Sevoflurane consumption during a FGF of 2.0 L·min^{-1} was 9.8 [9.4-10.3] mL with soda lime *vs* 9.8 [9.3-10.7] mL with Amsorb Plus® ($P = 0.42$). With a FGF of 0.5 L·min^{-1}, sevoflurane consumption was 3.9 [3.6-4.5] mL with soda lime *vs* 4.0 [3.4-4.6] mL with Amsorb Plus® ($P = 0.49$). Sevoflurane consumption between the two FGFs differed significantly for both absorbers (both $P < 0.001$, Figure). We conclude that Amsorb Plus® may facilitate a reduction in sevoflurane consumption by enabling low FGFs to be employed. Nevertheless, there seems no direct benefit from Amsorb Plus® if low FGFs are already employed with soda lime absorbers.

Trial registration: Clinicaltrials.gov (NCT04271462); registered 17 February 2020.

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