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LETTER TO THE EDITOR

Cases of carbon dioxide rebreathing without significant color change in the appearance of the carbon dioxide absorbent canisters

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To the Editor:

Three cases of carbon dioxide rebreathing without a significant color change in the appearance of the canisters were experienced during general anesthesia with the same model anesthesia machines; Aestiva/5 (Datex Ohmeda, Wisconsin, USA) with a fresh gas flow of 1–2 l/min. Carbon dioxide rebreathing was recognized because the inspiratory carbon dioxide baseline of the capnogram trace gradually rose. The inhalational carbon dioxide concentration decreased immediately after increasing the fresh gas flow, and rose again with decreasing the fresh gas flow. This indicates that carbon dioxide rebreathing was due to carbon dioxide accumulation in the semi-closed circuit system of the anesthesia machines.

A color change in the appearance of the carbon dioxide absorbent was recognized only in the upper part of the canister (Fig. 1a). The top surface of the canister showed a significant color change limited to the middle part of it (Fig. 1b). The section image of the canister showed a significant columnar color change of the carbon dioxide absorbent along the full length of the center part of it (Fig. 1c). The observation of the canister bottom of Aestiva/5 revealed that only the center part of it had the mesh part for the exhaled gas, and the color change of the carbon dioxide absorbent seemed to accord with the mesh part of the bottom (Fig. 1d).

As an experiment, when a transparent plastic partition wall was settled in the canister before filling with carbon dioxide absorbent, the columnar color change was no longer visible. This indicated that the flow of the exhaled gas was influenced by the wall in the canister. Considering these results, it is supposed that the structural characteristic of the canister bottom of the anesthesia machine; Aestiva/5, caused channeling and the inhomogeneity of the current of inhaled gas in the canister led to the columnar color change of the carbon dioxide absorbent.

The role of the carbon dioxide absorbent canister becomes more important as the fresh gas flow quantity decreases. A technique of using a fresh gas flow of 1 l/min was reported first in 1952 [1]. The technique with the fresh gas flow less than 1 l/min subsequently became known as "low-flow anesthesia". Afterwards, a technique using a fresh gas flow of 500 ml/min was reported as "minimal flow anesthesia" [2].

These cases of carbon dioxide rebreathing without significant color change in the appearance of the canisters provide very important information not only for anesthesiologists, but also for all persons using anesthesia machines. When carbon dioxide rebreathing is recognized, carbon dioxide accumulation in the circuit system of the anesthesia machines should be suspected and exhaustion of the carbon dioxide absorbent should be immediately

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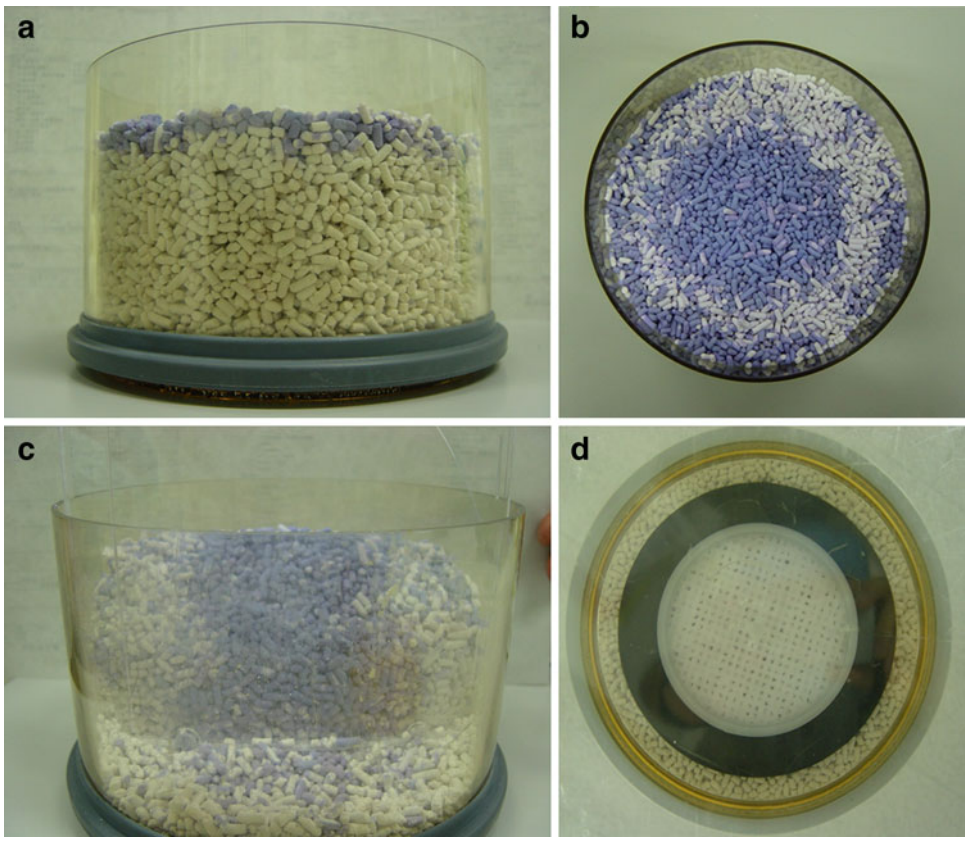

Fig. 1 Cases of carbon dioxide rebreathing were experienced without an apparent color change in the appearance of the carbon dioxide adsorbent in the canister. **a** A color change in the appearance of the carbon dioxide absorbent was recognized only in the *upper part* of the canister. **b** The *top* surface of the canister showing a significant color change limited to the middle part of it. **c** Taken after a plastic transparent partition wall was set after digging so that a section did not collapse. The section image of the carbon dioxide canister shows a significant columnar color change along the full length of the center part of it. **d** The canister bottom of Aestiva/5 (Datex Ohmeda, Wisconsin, USA). Only the center part of it has the mesh part for the exhaled gas

confirmed with observation of the top surface of the canister.

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Conflict of interest The author has reported no conflicts of interest.

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