

Obstruction Due to Retained Carbon Dioxide Absorber Canister Wrapping

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Proper functioning of every item of anesthetic equipment is of utmost importance in ensuring the safety of modern-day anesthesia. Accordingly, guidelines have been developed by several regulatory agencies for the safe manufacturing and use of most equipment used in anesthesia. As well, the Food and Drug Administration (FDA) has developed recommendations to test the integrity of all anesthetic apparatus prior to use (1). However, mishaps due to equipment failure still occur. Here we describe a case of breathing circuit obstruction due to failure to remove the packaging from a CO₂ absorber canister.

Case Report

A 57-yr-old, 160-cm, 100-kg woman underwent thyroid lobectomy for a "cold" nodule. She was otherwise healthy. A Dräger® Narkomed® 2B anesthesia machine (North American Dräger, Telford, PA) equipped with the Dräger® circle CO₂ absorber and plastic disposable hoses was used. It was checked in accordance with the 1993 FDA Anesthesia Apparatus Checkout Recommendations (1), using the complete checkout as this was the first case of the day. Midazolam 3 mg intravenously was administered in the holding area before transfer to the operating room. After breathing oxygen for 5 min, anesthesia was induced with fentanyl 150 µg, thiopental 500 mg, and succinylcholine 100 mg intravenously. The trachea was intubated easily with direct laryngoscopy. Upon subsequent manual ventilation with use of the anesthetic bag of the circle system, much resistance was noted and chest movements were minimal. Air entry was diminished but equal bilaterally, and although no actual wheezing was heard, the presumptive diagnosis was bronchospasm. After 1 min of ventilating with isoflurane, the resistance appeared to diminish, and controlled ventilation was attempted. Peak airway pressures were initially 40 cm H₂O but within 10 breaths reached 80 cm H₂O, with minimum airway pressures of 20 cm H₂O. The patient was immediately disconnected from the breathing circuit but

there was no change in measured airway pressures. This suggested that there was a problem with the ventilator or breathing circuit, which was confirmed when the patient was easily ventilated with a disposable resuscitation bag. Close inspection of the breathing circuit revealed a small red line on one of the disposable CO₂ absorber canisters (Sodalime®; Puritan Bennett Corp., Lenexa, KS), indicating that its wrapping was still on. Removal of this packaging allowed the patient to be ventilated normally with the ventilator. Throughout this entire time the oxygen saturation of hemoglobin remained more than 90% and the ETco₂ pressure ranged between 20 and 33 mm Hg. The remainder of the case proceeded uneventfully.

Discussion

This report illustrates a major potential hazard with current packaging of certain disposable CO₂ absorber canisters. This plastic wrapping is completely transparent except for one short red line along the side and a small red label on the upper surface that states "remove wrapper before use" (Figure 1). If the canister is erroneously placed into the absorber with the wrapping still in place, the red line would be difficult to detect by casual inspection and the upper label would not be seen at all (Figure 2).

With the known fallibility of humans, it is almost inevitable that there will be instances when this type of wrapping will not be removed. Indeed, 20 years ago two similar cases were reported involving failure to remove paper seals from the top and bottom of pre-packaged absorber canisters (2). Two manufacturing strategies that would prevent the occurrence of any further incidents are switching to an opaque or tinted wrapping or ensuring that it is physically impossible to insert a wrapped canister into a CO₂ absorber.

More important is the observation that the equipment used in our case appeared to have passed a complete preoperative check according to the 1993 FDA Anesthesia Apparatus Checkout Recommendations (1). To explore this further, a wrapped canister was intentionally placed into the same machine used in the case. When the oxygen flush was activated with

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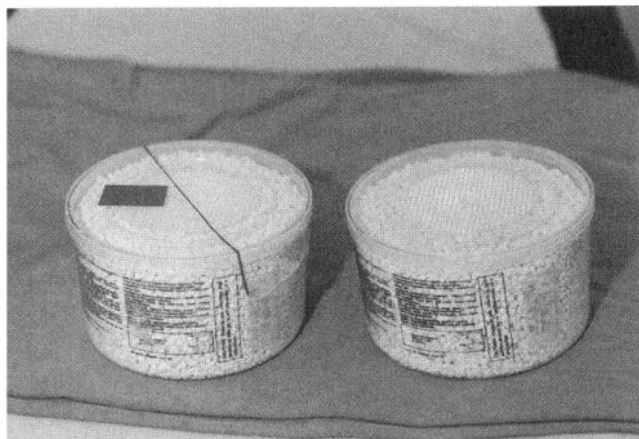


Figure 1. Wrapped and unwrapped Sodalime® canisters. Note the small line (a red line on the package) and label on the transparent packaging.

the Y piece occluded, the pressure gauge initially read less than 10 cm H₂O, then slowly increased to more than 30 cm H₂O. If the oxygen flow was not set to minimum before checking the ventilator with the breathing bag even this part of the checkout was passed. The ventilator pressures were much higher than would be expected but an unwary trainee or even a tired anesthesiologist might overlook this. At expiration, the breathing bag (simulated lungs) failed to fully collapse, but the pressure gauge did return to zero. The only part of the FDA check that would have clearly indicated a problem was the assessment of manual ventilation using simulated lungs and relying on the anesthesiologist's "educated hand" to detect the partial obstruction. This, however, is often omitted in clinical practice due to the need for two anesthesia bags. When one attempted to breathe from the circuit, an obstruction to inspiration was readily apparent. In the case reported the patient failed to mention this possibly due to sedation or poor mask fit. Interestingly, repeating the entire checkout procedure with another wrapped canister produced even less evidence of obstruction.

The 1986 version of the FDA Checkout Recommendations (3) recommended breathing through the anesthetic circuit. Although fraught with the potential for contamination of either the circuit or the anesthesiologist, this maneuver clearly identified the presence of an obstruction. Perhaps it should be returned to the current set of Recommendations.

In summary, a case of obstruction of an anesthetic breathing circuit due to failure to unwrap a disposable

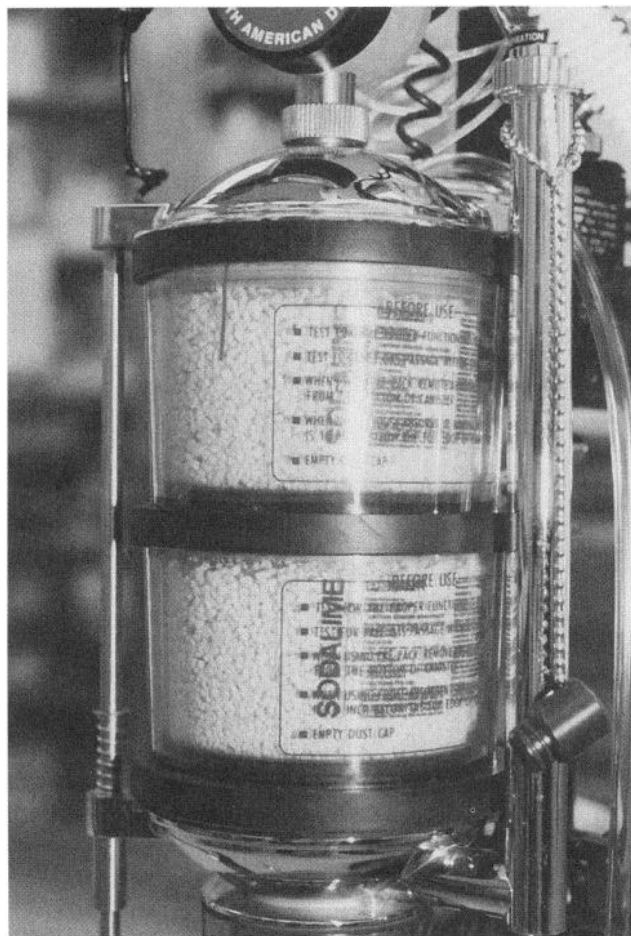


Figure 2. Wrapped and unwrapped Sodalime® canisters in the CO₂ absorber. The wrapped cartridge is on the top. The thin line (a red line on the package) can be seen in this photograph, but it is far less evident in the visually busy operating room environment.

CO₂ absorber cartridge is presented. We suggest similar incidents could be easily avoided by making the wrapping opaque, tinted, or physically impossible to insert into the circle absorber.

References

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3. Andrews JJ. Inhaled anesthetic delivery systems. In: Miller RD, ed. *Anesthesia*. 4th ed. New York: Churchill Livingstone, 1994: 224-5.