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A New Device to Check the Anesthesia Machine Low-pressure System

To the Editor:—The 1987 and 1992 Food and Drug Administration Anesthesia Apparatus Checkout Recommendations suggest a leak check of the anesthesia machine low-pressure system be done daily.[1,*] We describe a new suction device, made from readily available equipment, that can be used to perform this test.

The low-pressure system (vaporizers, connecting manifolds, flow meter tubes, and common gas outlet check valve, if present) has been shown to malfunction frequently in clinical use.[2–4] The potential consequences of these failures include contamination of the operating room with anesthetic gases, patient awareness under anesthesia, and delivery of a hypoxic gas mixture to the patient despite flow meters being set to deliver a nonhypoxic mixture.*

In an anesthesia machine, any check valve in the common gas outlet isolates the low-pressure system from the positive pressure in the breathing circuit. Hence, in the presence of such a valve, a positive-pressure system leak check (performed by occluding the Y-piece of the breathing circuit, applying pressure to the circuit, and observing the pressure gauge on the anesthesia machine for a decline in pressure) may fail to detect a leak in the low-pressure system.[4]

The negative-pressure test, in contrast, will identify leaks in the low-pressure system even if a check valve is present. Since the negative-pressure test is effective in machines with and without a check valve, it is the test recommended in the 1992 FDA guidelines, which follow*:

a. Verify that the machine master switch and flow control valves are OFF.
b. Attach "Suction Bulb" to common (fresh) gas outlet.
c. Squeeze bulb repeatedly until fully collapsed.
d. Verify bulb stays collapsed for at least 10 seconds.
e. Open one vaporizer at a time and repeat 'c' and 'd' as above.
f. Remove suction bulb, and reconnect fresh gas hose.

Because some of our anesthesia machines were delivered without suction devices, and others had their devices lost or damaged, we fabricated replacements.

The bulb pump was cut from a disposable Y-type blood set (part no. 1873, Abbott, North Chicago, IL) in such a way as to preserve the bulb's two built-in one-way valves and the 12-cm tubing leading to the pump inflow. With ethyl alcohol as a lubricant, the adapter from a disposable 2.5-mm inner diameter endotracheal tube (part no. 151025, Portex, Wilmington, MA) was inserted into this tubing.

The operation and maintenance manual provided by one anesthesia machine manufacturer† specifies that the suction device generate and hold at least 65 mmHg negative pressure without leaking for 60 s. With our device, a negative pressure of 165 mmHg could be produced. When the free end of the endotracheal tube adapter was inserted into the common gas outlet of an anesthesia machine and the bulb held upright and pumped (fig. 1), the device held full suction with no leakage during a 5-min test.

This device is effective, inexpensive, convenient to use, and can

Fig. 1. An inverted pump from a Y-type blood set attached to a 2.5-mm inner diameter endotracheal tube adapter applies sustained suction to identify leaks in the low-pressure system even if a check valve is present in the common gas outlet.

* Good ML: Comments sought on new FDA preanesthesia checklist. Anesthesia Patient Safety Foundation Newsletter 7:37–52, 1992–93.

† Ohmeda Modulus II Plus Anesthesia System Operation and Maintenance Manual. Section 4-2. Revised. BOC Health Care, March 10, 1989.

be made by any anesthesiologist in a few minutes from readily available materials.

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Unusual Complication of Nasotracheal Suctioning

To the Editor:—It has been the practice in our surgical intensive care unit to insert a soft nasopharyngeal airway to facilitate nasotracheal suctioning. This is done to minimize trauma to the nasal tissues of repeated passage of the tracheal suction catheter. We report an unusual case of respiratory distress due to displacement and aspiration of a nasopharyngeal airway as a result of this practice.

The patient was a 79-y-old, 73-kg man who had undergone an uncomplicated combined three-vessel coronary artery bypass graft procedure and left carotid endarterectomy 2 days previously. The trachea was extubated successfully on postoperative day 1, and he maintained a peripheral arterial hemoglobin oxygen saturation (Sp_{O_2}) of 98% while breathing 50% O_2 *via* face mask. On the morning of the second postoperative day, while breathing 5 l/min O_2 through nasal cannulae, the Sp_{O_2} decreased to 92%. Because rhonchi were heard, the intensive care nurse elected to perform nasotracheal suctioning. A size 26 Bardex nasopharyngeal airway was lubricated (Surgilube, E. Fougera, Melville, NY), both internally and externally, and passed atraumatically into the left nostril. Next, a 14-Fr 55.9-cm suction catheter (Regu-Vac, Becton Dickinson, Lincoln Park, NJ) was passed through the nasopharyngeal airway.

After partial insertion of suction catheter, the nurse noticed that the nasopharyngeal airway was no longer visible, and the patient complained of respiratory difficulty. Direct visual examination of the oral and nasal cavities failed to reveal the location of the nasopharyngeal airway, and the anesthesiology service was notified emergently. At this time, the patient was agitated and appeared to be in mild respiratory distress with stridorous breath sounds and mild sternal retractions. The blood pressure was 140/57 mmHg, heart rate 63 beats/min, respiratory rate 20 breaths/min, and Sp_{O_2} 85%. The patient's voice was hoarse and attenuated. There was blood in the posterior oropharynx. Incremental doses of midazolam were administered (3 mg total dose), and the oropharynx was sprayed with nebulized local anesthetic. With patient cooperation, direct laryngoscopy was performed, and the proximal (trumpet) end of the nasopharyngeal airway was seen protruding from the glottic opening. The patient was breathing through the nasopharyngeal airway, which was lodged in the trachea. A hemostat was used to extract the nasopharyngeal airway, and the patient immediately returned to normal respiratory function.

In the situation described, the intensive care nurse followed the standard hospital procedure of employing a nasopharyngeal airway as a guide for nasal insertion of a tracheal suction catheter. It is common to use the smallest possible nasopharyngeal airway to minimize nasal trauma and discomfort. On laboratory examination, the 14-Fr tracheal suction catheter passed through a lubricated size 26 Bardex nasopharyngeal airway, although it was a snug fit. However, in the patient described above, anatomic or other factors resulted in the tracheal suction catheter pushing the entire nasopharyngeal airway through the nasopharynx and, aided by patient ventilation, directly into the trachea.

We recommend that, if a nasopharyngeal airway is employed for nasotracheal suctioning, a large well lubricated nasopharyngeal airway be inserted and close attention paid to its position during suctioning.

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