CASE REPORT

To Do or Not to Do a Preinduction Check-Up of the Anesthesia Machine

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The anesthesia machine check is an integral part of the anesthesiologist’s daily routine. It is standard operating procedure to check the high- and low-pressure systems of the machine as well as other integral parts that are accessible. Many new anesthesia machines offer a self-testing capability, but older ones with fewer electronics on board are still widely used. Whether the machines self test or not, each machine contains a CO₂ absorber and a circuit that may be prone to problems. In our case we encountered an open CO₂ absorber after a service of the machine had been performed between the cases without our knowledge. We were unable to ventilate the patient during induction. The presence of a backup self-filling manual ventilation bag was invaluable in preventing an otherwise inevitable emergency. (Anesth Analg 2005;101:774–6)

Case Report

A 54-yr-old male patient with hypertension, gastroesophageal reflux, hepatitis C, epilepsy, schizophrenia and bipolar disorder was scheduled for umbilical hernia repair. Airway examination revealed Mallampati class I with a good mouth opening and partial upper denture, which was removed before leaving the holding area.

On arrival in the operating room (OR), the patient was positioned supine on the surgical table and standard monitoring was applied. Administration of oxygen was performed with a standard face mask attached to the circuit of a Datex-Ohmeda Modulus II anesthesia machine (Ohmeda, Madison, WI). The SpO₂ increased from 96% on room air to 100% and anesthesia was induced with propofol, fentanyl, a pretreating dose of cisatracurium, and succinylcholine. The apneic stage was reached and the resident attempted mask ventilation, but no ventilating pressure could be achieved in the circuit and no gas moved. The sound of gas escaping from the system was heard and the machine was quickly inspected. An opened CO₂ canister was found and the top part contained no soda lime. Despite closing the circuit, no ventilation was possible. The resident attempted endotracheal intubation, which failed as a result of esophageal placement. The endotracheal tube (ETT) was removed and the patient’s lungs were ventilated with a mask and self-filling manual ventilation bag to maintain oxygenation until the ETT was inserted on the second attempt by the attending anesthesiologist. Ventilation was continued and oxygenation was maintained with the self-filling manual ventilation bag, stored in the room. Anesthesia was maintained with bolus doses of propofol until the absorber was replaced and the machine was functional again. The case continued uneventfully and the patient was extubated at the end of surgery, which was followed by a complete recovery.

Discussion

This was the second case for the day in this OR. The anesthesia machine was inspected in the morning according to the ASA/Food and Drug Administration (FDA) guidelines (1) before the first case. The first case finished and the circuit was exchanged. The circuit was checked again for leaks and the room was prepared for the second case. While the resident was getting the patient, the anesthesia technician came into the room and started to change the soda lime. In the process, the technician was emergently dispatched to another room and left the machine in the process of maintenance. There were no visual marks that the machine was being serviced as the resident and the patient entered the room. The position of the canister was such that it could not readily be seen from the standing position of the anesthesiologist preinduction or during anesthesia induction (Figure 1). A disconnection cannot be easily appreciated if both containers are full with the soda lime and the canister is left open because the locking mechanism lowers only enough to allow canister removal (Figure 2). During the administration of oxygen, oxygen saturation increased because we were able to deliver oxygen from the inspiratory limb of the machine. The fresh gas inlet is positioned after the absorber in the circuit and the delivery of a larger concentration of oxygen to the patient is thus possible.

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It should suffice to have one extensive check-up of the circuit and the machine according to the FDA guidelines before the first use of the day (1). Every consecutive use should be preceded by at least a pressure test of the circuit (1). In this case a quick preinduction pressure test of the circuit was performed just before going to get the next patient; however, a quick leak test should be performed just before placing the mask on the patient. Thus the practitioner will confirm the continuity of the circuit and can also ensure that the switch is turned toward the pop-off valve and not toward the bellows of the ventilator.

Approximately 2% of 3791 closed claims have resulted from gas delivery equipment. Death and permanent damage were cited in 76% of the outcomes (2). A review of the Closed Claims Project database reveals that the breathing circuit was the most common culprit and the OR was the scene of the events in 86% of the cases related to the gas delivery system (2). Equipment misuse was three times more common than equipment failure (2). Ancillary personnel were at least partially the cause of errors in 30% of the cases (2). Misconnects and disconnects of the breathing circuit were cited in 35% of the 72 claims (3,4). A more recent review of the Closed Claims Project database by Eisencraft (5) noticed a decreasing trend in the gas delivery related problems as a portion of the total claims (3% in 1970s, 2% in the 1980s, and only 1% in the 1990s). Furthermore, the outcomes from these events from the 1990s appeared to be less severe than earlier claims.

A review of the incident at our institution showed the importance of an additional pressure leak check of the machine just before administration of oxygen. It consists of occluding the Y-piece of the breathing circuit, setting the ventilator switch to manual/spontaneous mode, closing off the adjustable pressure limiting (APL) valve, and inflating the breathing bag with oxygen from the oxygen flush valve while keeping the gas flow closed. A sustained pressure of 40 cm H2O for 10 s confirms the continuity of the system and assures that a ventilator is preset to the spontaneous/manual ventilation mode. An alternative suggestion could be to ensure that the breathing bag deflates and inflates during administration of oxygen, which would ensure the intactness of the breathing circuit and mask fit and the correct APL valve position. Our standard operating procedure requires that the anesthesia machines be serviced by the anesthesia technician early in the morning before the first machine.

Figure 1. CO2 absorbers from the view of the attending anesthesiologist at the time of anesthetic induction.

Figure 2. CO2 absorbers: straight-on view with arrow pointing toward disconnected absorbers.
check by the anesthesia provider. In the event additional service is required, we have revised our procedures such that the technician will leave a visible service tag on the machine to alert the anesthesia provider of possible changes in the integrity of the machine. A backup ventilation device must always be available in the OR, as required by step 1 of the FDA recommendations (1). In our institution, it is the self-filling manual ventilation bag that is positioned behind each machine in every OR. The new generation anesthesia machines can perform very thorough self-tests, including high- and low-pressure tests, but it remains the responsibility of the individual anesthesia provider to assure proper anesthesia machine function before every anesthetic.

References