A major leak from the condenser assembly of the anesthesia workstation

Dear Editor,

From a simple pneumatic device of the early 20th century, the anesthesia machine has evolved to incorporate various mechanical, electrical and electronic components to be more appropriately called anesthesia workstation.[1] Despite advanced technology, a remote but life-threatening possibility of intraoperative machine malfunction exists. The leakage in the anesthesia circuit may result in hypoventilation, hypoxia, awareness, pollution of operating room and ventilatory failure even leading to death.[2] Various causes of leaks in the breathing system have been reported in the literature that includes failure of an adjustable pressure limiting valve to close, mis-installation of a canister,[3] weak connections in between different parts of the breathing circuit.

We reported a case of gas leak from an unconventional site in the Datex Ohmeda Aespire View (GE Healthcare Pvt. Ltd. (India), Bangalore, India) workstation after anesthesia machine checks. As a routine, the complete pre-use anesthesia machine check was performed through the electronic self-check. A complete pre-use check of the machine included cylinders, pipelines, low-pressure system, vaporizers, breathing circuits, monitors and integrated ventilator. The circle system was also checked for any leaks and the ventilator systems were checked by setting the oxygen flow meter at minimum flows.

However, after preliminary checks, soda lime in the carbon dioxide (CO_2) absorber canister was changed. The canister was then reattached firmly. The water trap was also drained at this time.

The patient was induced with propofol but bag mask ventilation was not adequate. There was a chest rise along with an end tidal CO_2 trace but the reservoir bag was not filled adequately at a usual flow of 5 L/min. An oropharyngeal airway was inserted, and the flow increased to 10 L/min and the bag was filled better. The trachea was intubated with an 8.5 mm internal diameter cuffed endotracheal polyvinyl chloride tube using succinylcholine. However, the bag still required higher flows to fill up and when turned to the ventilation mode, the bellows required more than 8 L/min to fill up. We checked all the connections in the external circuit but found no loose connections or leaks. However, there was a large audible leak heard from the soda lime canister assembly. The CO_2 absorber canister was removed and put back again to ensure that it is secured appropriately and locked. However, the audible leak still persisted. We decided to go ahead with the surgery as it was an emergency and ventilate the patient manually using Bains circuit.

After the surgery got over, a detailed inspection of the CO_2 canister assembly was done, and the leak seemed to originate from the EZchange and condenser part of the machine (**Figure 1**). Further evaluation revealed no issue in the EZchange part. The drain button of the condenser, however, was stuck in a semi-open position due to a soda lime granule trapped under the flap valve, leading to the leakage of gases through the condenser via the water drain (**Figure 2**). Once the granule was cleaned out from underneath the flap valve, the drain button was restored to the original position and the audible leak was eliminated, as was evident upon rechecking the machine.

Figure 1: Canister on the machine with EZchange option. Note: 1: EZchange Canister manifold; 2: condenser; 3: drain button.

Figure 2: Leak site in the condenser assembly.

The EZchange and condenser option are included in the Advanced Breathing System of the Datex Ohmeda Aespire View workstation. The EZchange option allows the user to change a canister during a case without introducing a large leak and the condenser (**Figure 1**). The condenser helps to remove moisture from the freshly scrubbed gas that comes out of the canister before going to the inspiratory flow sensors. This moisture is then drained out at the bottom of the condenser through the water drain.

A similar experience was reported by Kummar et al.[4] using the Aisys Carestation in 2009. A possible explanation in their case was that a high content of dust in the absorbent material was carried by the flowing gas that may have carried that dust through the breathing system, leading to deposits caking in the condenser reservoir.

The reusable canister design incorporates two separate mechanisms to prevent the migration of absorber material into the circuit. There is a metal grate designed to contain particles of more than 1 mm and a foam filter designed to trap dust particles. These mechanisms were found to be intact in our case.[4]

It is very difficult to explain the presence of absorbent granule in the lower part of the condenser assembly, thereby causing a circuit leak in our case. There was a high content of dust in the absorbent material used. But how it could reach the condenser assembly is difficult to explain.

Modern-day workstations have evolved and become complex

over the years. A malfunction that occurred in our case might be difficult to recognize early unless the staff using anesthesia workstations is well versed with all the components of the machine and should have completed the clinical training test in the user manual. The user manual should be kept readily available at all times. After the anesthetic machine check is completed, no component (circuits, bellows, vaporizers, absorber canister) should be changed at will. If there is a requirement to do so, the machine check should be performed all over again. In machines equipped with a condenser, a visual check of the condenser and reservoir should be done daily and it should be ensured that the water drain push button is moving freely and not stuck. Alternative methods of ventilation and provision of anesthesia should always be available.

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