Failed ventilation due to heat and moisture exchanger filters malfunction

Sir,

The consequences and catastrophes due to manufacturing defects in the medical equipment can increase mortality and morbidity especially if such malfunctioning goes undetected for a fairly long duration. Heat and moisture exchanger filters (HMEF) are commonly used during surgeries of moderate to long duration for preserving pulmonary hydration and temperature as they are economical and easy to use.[1] There have been concerns regarding the malfunctioning of HMEF when the patient stays on mechanical ventilation for a long duration.[2] We report the case of complete respiratory obstruction due to a manufacturing defect in the HMEF in a 38-year-old woman, scheduled for laparoscopic cholecystectomy.

After induction of anesthesia and tracheal intubation with cuffed 7.5-mm ID endotracheal tube (ETT) ventilator settings were adjusted to 500 ml tidal volume, respiratory rate of 12/min, and oxygen:nitrous ratio of 40: 60. The HMEF was attached beyond the Y-connector of the breathing circuit. After 3–4 min of mechanical ventilation, it was observed that patient’s chest did not show any breathing movements, which was confirmed by absence of air entry on auscultation but there were no changes in ventilator parameters and spirometry. The capnograph did not show a trace. The closed breathing circuit was disconnected immediately. Ventilation was difficult even with a Bains circuit attached thereafter. The HMEF was detached and we were able to ventilate the patient with ease. The procedure was uneventful thereafter. A detailed inspection of the HMEF later revealed that one its component had dislodged which possibly caused the obstruction [Figures 1 and 2].

The routine use of HMEF has been strongly recommended to avoid the obstruction during use of mass spectrometer in patients undergoing general anesthesia.[3] HMEF obstruction by contaminants, condensed water, hemoptysis, and proteinaceous material have been reported. However, a complete breathing obstruction of HMEF due to manufacturing defect, such as one-way valve causing air trapping, is rare.[4,5] Tension pneumothorax after the soiling of the HMEF (in the expiratory limb) with sputum, inflammatory cells, and ciliary epithelium has been described.[6] The obstruction can mimic airway obstruction, silent chest due to severe bronchospasm, pneumothorax, ventilator malfunction, unseen leakage, and breathing circuit obstruction.[2,4-6] In the present case, inspiratory obstruction occurred and the airway monitors failed to detect it as the gases passed out through the sensor in the expiratory limb.

The inner component of the filter may have been loose and may have been dislodged by the positive pressure ventilation. Although monitoring on modern machines is reliable, this case shows that such accidents may still occur.

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Figure 1: Inner view of the HMEF through the connector showing no significant detectable defect

Figure 2: View of HMEF from the side showing a dislodged component of the filter
Obstruction to scavenging system tubing

Sir,

Obstruction to the scavenging system might result in serious complications including risk of pneumothorax. Several causes for obstruction had been highlighted in the literature.\[1-5\] We report a rare cause of obstruction to the scavenging system.

A 30-kg, 12-year-old girl was scheduled for open reduction and internal fixation of fracture both bones forearm. Anesthesia machine with circle system (Signet-615, Av.ulco Healthcare Pvt. Limited, Pondicherry, India) and anesthesia ventilator (eV-700, Av.ulco Healthcare Pvt. Limited, Pondicherry, India) were checked as per standard protocol. General anesthesia was induced by standard technique using midazolam, fentanyl, thiopentone, and vecuronium. After confirming endotracheal intubation, lungs were mechanically ventilated (tidal volume 250 ml, respiratory rate 14 per min, and inspiratory to expiratory ratio 1:2) with no positive end-expiratory pressure (PEEP). While observing the peak airway pressure in ventilator display to adjust tidal volume, we noticed PEEP developed and increased gradually to 10 cm of water with increasing peak inspiratory pressure. Ventilation was switched over to manual and normal airway pressure was re-established. Patient’s vital signs were normal and auscultation revealed no evidence of pneumothorax. Manual ventilation was continued throughout the intraoperative period and the remaining surgical period was unremarkable. Postoperatively, there was no clinical or radiological evidence of pneumothorax.

No visible obstruction to the breathing circuit and scavenging system transfer tubing were found; ventilator malfunction was suspected. Using a test lung, the ventilator was tested on similar ventilator settings. The PEEP gradually increased to 20 cm of water. The scavenging system transfer tubing was disconnected to examine the ventilator exhaust port because any obstruction to the ventilator exhaust port would result in such a problem, and it was found to be normal. However, the PEEP became zero on disconnection, which helped us to locate the obstruction to the scavenging system transfer tubing.

References

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