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Complications Related to the Use of a Heat and Moisture Exchanger

To the Editor:—A heat and moisture exchanger (HME) is commonly used in anesthetic practice and is widely believed to be a risk-free means of maintaining temperature and humidity in the patient whose trachea is intubated. However, we report two cases in which the use of HMEs represented additional risk to the patient.

Case 1

A 21-yr-old man was admitted to our hospital emergency room after suffering a close range gunshot wound to the mandible. Initially, airway management included nasal tracheal intubation, and later, elective tracheostomy. Several days after admission, the patient came to the operating room for a deltopectoralis flap with bone plate to the left mandible. The anesthesia breathing circuit was connected to the patient's ID 7 Shiley tracheostomy. An HME (Mallincrodt® Critical Care Inline Foam Nose) was inserted into the breathing circuit between the patient and the circle system. Anesthesia induction and maintenance were uneventful until 4 h after the start of surgery, at which time the low pressure alarm of the Drager 2B anesthesia machine, set at 8 cmH_2O, sounded. Incomplete reexpansion of the mechanical ventilator bellows was noted at end-expiration. Manual ventilation was only effective at high fresh gas flow rates. A large leak in the circuit was apparent. Inspection of the circuit, which was made difficult by the presence of surgical drapes, revealed all connections to be secure. After a short period of rechecking the circuit and anesthesia machine for leaks, gas was felt emanating from the HME. The HME was removed and replaced with an identical Mallincrodt® Inline Foam Nose. No further leak was apparent and mechanical ventilation was resumed. Visual inspection of the HME revealed a partial separation between the two interconnecting parts of the molded plastic housing (fig. 1). The degree of separation is exaggerated in the photograph for purposes of illustration.

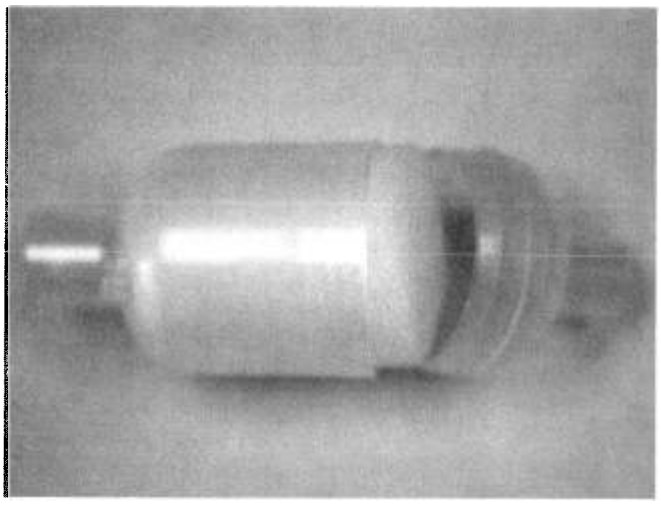

FIG. 1. Mallincrodt® Critical Care Inline Foam Nose. The site of separation between the interconnecting parts of the molded plastic housing is shown.

Case 2

A 27-yr-old man was scheduled for emergency thoracotomy following a gunshot wound to the left anterior thorax with evidence of massive hemothorax. The patient arrived in the operating room with his trachea intubated. Frequent suctioning of blood from the endotracheal tube was required. The tracheal tube was connected to an airway circuit containing an HME (Gibeck Respiration AB Humdi-Vent® 1). General anesthesia was initiated uneventfully. One hour later the patient's peak inspiratory pressure rose to 45 cmH_2O from a baseline of 32 cmH_2O. Repeated suctioning of the tracheal tube did not improve the situation and the patient's pulmonary compliance appeared to decrease even further. The end-tidal carbon dioxide value rose by 50% and, shortly thereafter, the end-tidal CO_2 tracing was not seen. At this time, the HME was noted to be saturated with blood. The HME was removed, resulting in significant improvement in ventilation and return of the end-tidal CO_2 tracing.

In Case 1, a defect occurred in the HME housing that resulted in a significant leak and had potentially serious consequences for the patient. No other reports of an HME leak in the literature could be found. In a personal communication, the manufacturer reports that prior to June 1986, the components of their HME snapped together, but after that date a hot melt glue was added to decrease the likelihood of separation.

In Case 2, HME saturation with blood resulted in an increase in airway resistance and an increase in difficulty ventilating the patient's lungs. The potential existed for total airway occlusion had the source of obstruction not been identified. Most HME manufacturers warn users of the potential for accumulated secretions to cause HME occlusion. It may be argued that hemoptysis is a contraindication to the use of an HME.

The addition of an HME into an airway circuit increases the number of airway connections and amplifies the likelihood of accident by increasing what Gaba *et al.* term the "proliferation complexity" of the system.[1] While the HME is generally a safe device that efficiently maintains airway heat and humidity, there are intrinsic risks in its use.

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Reference

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