



What?

Heat Moisture Exchange unit (HME). Most also have a bacterial/viral filter (HMEF)

What's it for?

(1) to maintain humidity of inspired gases. You will remember from previous KoTW (High Flow Nasal Cannulae) that humidified gases are more comfortable to breathe, preserve muciliary escalator function and reduce the risk of airway obstruction from dried secretions.

(2) To filter out bacteria and viruses to avoid cross infection of ventilator equipment.

Is it any good?

The proposed benefits are ease of use, portability and reduced cost compared to humidified circuit; protection of circuit and staff from cross-contamination, and potential reduction in ventilator associated pneumonia (VAP) rates.

Essentially much cheaper and less labour intensive than using a wet circuit... But also less effective.

What are its key features?

Clear plastic housing for safety inspection
Standardised connectors at either end
Gas-sampling port (used for the ETCO₂ in ACCU)
Hygroscopic (water-absorbing) layer of foam/paper
Pleated electrostatically charged/hydrophobic layer

How does it work?

You will see these inserted into the ventilator circuit-near the patient. Moist air from the patient's lungs passes over the membranes in the filter. The hygroscopic material causes condensation and release of thermal energy. When the dry gas passes back in inspiration, the water evaporates again supplying a humidified gas mixture to the patient.

The HME process therefore depends on the water content of the patient's exhalation and her temperature.

The bacterial/viral filter intercepts larger particles on impact a bit like a fish net. Smaller charged viral particles stick to the electrostatically charged layers directly or are contained in water droplets that form on the hydrophobic layer.

The filtering process is less efficient with a thinner filter layer and at higher gas flow rates.

The hazards

- (1) Blockage- **can be fatal**- needs routine daily change- visually check as part of ventilation troubleshooting. HMEFs can be dangerous for patients with copious tenacious secretions as they can clog the filter.
- (2) Increased dead-space- 5-90ml volume depending on model. In small tidal volumes, this can contribute significantly to proportion of a breath that takes no part in gas exchange
- (3) Increased airway resistance- All HMEFs increase resistance- if you reduce the volume of the filter, you further increase the resistance to gas flow. Think of blowing through a straw.
- (4) HMEFs do not work for patients who have large airway leaks (e.g. bronchopleural fistula)
- (5) **Must not be used concurrently in a wet circuit** (one with an attached heated water-containing chamber). The HME will rapidly become saturated with liquid and may block. A bacterial filter may be used at the ventilator end of the circuit.
- (6) Compared to a wet circuit (see below), the HME does not provide quite enough humidity of gas. This can lead to inspissation (drying) of secretions and airway obstruction.

