

Pierre-Eric Danin  
Jean Dellamonica  
Gilles Bernardin

## Precautions with heated humidifier systems in particular environments

Accepted: 6 May 2013  
Published online: 18 May 2013  
© Springer-Verlag Berlin Heidelberg and ESICM 2013

Dear Editor,  
Heated humidifier (HH) devices are widely used during mechanical ventilation in intensive care units. They are efficient in humidifying the delivered gases, and lower the dead space compared with heat and moisture exchange (HME) [1], but the ambient temperature and the ventilator's output temperature may affect the process [2]. An auto active compensatory algorithm has been developed to improve the humidifier performance. It is supposed to counter excessive heat of the inlet gases and prevent excessive condensation in the circuitry by automatically adjusting the temperature in the chamber to increase evaporation, despite a small difference in temperature between input and output gases. This device has demonstrated good experimental and clinical efficiency [2].

We experienced in our department episodes of moisture insufficiency since starting to use the MR 850 humidifier HH device with RT 340 consumables (Fisher and Paykel, Auckland, New Zealand), in normal conditions and with conventional

ventilation settings. We noticed each time the absence of condensation in the HH chamber wall or Y-piece (normally related to humidity performance), together with thick secretions, atelectasia, and endotracheal tube obstruction, requiring a re-intubation in one patient. Both ventilators used in our unit were concerned (Engstrom, General Electric and Puritan Bennett 840, Covidien). These inconveniences stopped when the HH was changed for a HME (Humid-vent, Teleflex Medical, Ireland), with clinical improvement in ventilation and oxygenation, leading to a decrease in utilization of HH in our unit.

The ambient temperature in our unit is about 26 °C, and stable during the day thanks to air conditioning. Rooms are south, east, and west oriented in a sunny area, and capture, for this reason, a lot of natural light and heat during the day. The HH were never directly exposed to the sun, and regular maintenance was effected by the hospital's technical department and certified by a manufacturer engineer. The ventilator outlet temperature gases were more than 30 °C (31 °C for Engstrom, 33 °C for Puritan Bennett, personal data).

It appears that, in our climatic and equipment conditions, the automatic compensation algorithm set on HH led to a shortage of humidity. The conjunction of high temperature of ventilator output gases and high ambient temperature is suspected to make the algorithm ineffective to detect a need for increased energy (provided by the heat plate in the chamber) to saturate with water vapor the heated dry gases coming from the ventilator.

After investigations with the manufacturer, we switched the compensation algorithm to a manual

mode, by setting 40 °C for the outlet chamber and 40 °C for the Y-piece. The higher energy provided by the plate improved the airway humidification with a corresponding increase in inspiratory limb condensate, and resolved the secretion thickening, with clinical improvement in ventilation.

Despite the compensatory algorithm design for high ambient temperature and high inlet chamber temperature, caution must be kept in mind while using this device in warm environments. We should recommend switching the system to a manual mode (40/40) if airway humidification appears to be inadequate.

**Conflicts of interest** We thank A. Mumford (Senior Product Manager from Fisher and Paykel, New Zealand) for his help in understanding and solving the problem.

## References

1. American Association for Respiratory Care, Restrepo RD, Walsh BK (2012) Humidification during invasive and noninvasive mechanical ventilation: 2012. *Respir Care* 57:782–788
2. Lellouche F, Taille S, Maggiore SM, Qader S, L'Her E, Deye N, Brochard L (2004) Influence of ambient and ventilator output temperatures on performance of heated-wire humidifiers. *Am J Respir Crit Care Med* 170:1073–1079

P.-E. Danin (✉) · J. Dellamonica · G. Bernardin  
Réanimation médicale, CHU de Nice  
Hôpital l'Archet, Université de Nice Sophia  
Antipolis, 151 Route de St Antoine de  
Ginestière, BP 3079, 06202 Nice cedex,  
France  
e-mail: danin.pe@chu-nice.fr  
Tel.: +33-4-92035510  
Fax: +33-4-92035607