Comparison of a Novel Humidifier and Passover Humidifier During High Frequency Oscillatory Ventilation

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Background

- Humidification of inspired gas during mechanical ventilation is very important because the patient's own humidification system has been bypassed by the endotracheal or tracheostomy tube.
- Inadequate humidification during high frequency oscillatory ventilation (HFOV) may be a concern since only a small proportion of inspiration is accomplished by tidal breathing bulk flow as experienced during conventional mechanical ventilation (CMV) .
- In the adult population a high bias flow (≥ 30 lpm) is used during HFOV which differs from the reliance of bulk flow delivery during CMV.

Objective

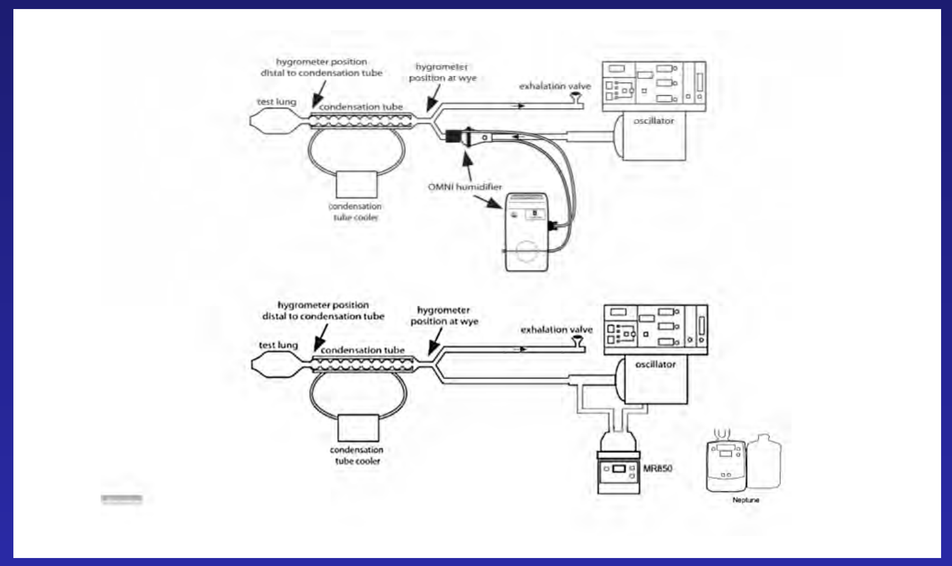
- To examine humidification during HFOV of a standard, commonly used passover humidifier and a novel humidifier employing capillary force technology.

Methods

- A Sensormedics 3100 B oscillator (Cardinal Health, Yorba Linda, CA) was set at the following parameters:
  Paw 30cm H2O
  Power 6.0
  Ti 33%
  Frequency 6 Hz
  Bias Flow 30 lpm
  FiO2 .21
- The 3100B was connected to a condensation tube then to a test lung. The condensation tube served to approximate the upper airways and allow for condensate collection.
- The first study run (60 minutes) was done using the MR850 passover humidifer (Fisher & Paykel, Auckland, NZ) as the humidification source.
- The second study run (also 60 minutes) was done using the Hydrate OMNI capillary force humidifier (Hydrate Inc, Midlothian, VA) as the humidification source.
- Placement of the humidifiers on the inspiratory limb differed from one another as evidence in figure 1. Both humidifiers were set at 37 degrees Celsius.
- Temperature and humidity measurements were taken at the patient wye and at the distal end of the condensation tube.

- Absolute humidity was calculated from the equation below:
  $AH = ((0.00031243 \times T^3) + (0.0081847 \times T^2) + (0.32321 \times T) + 5.081) \times RH$

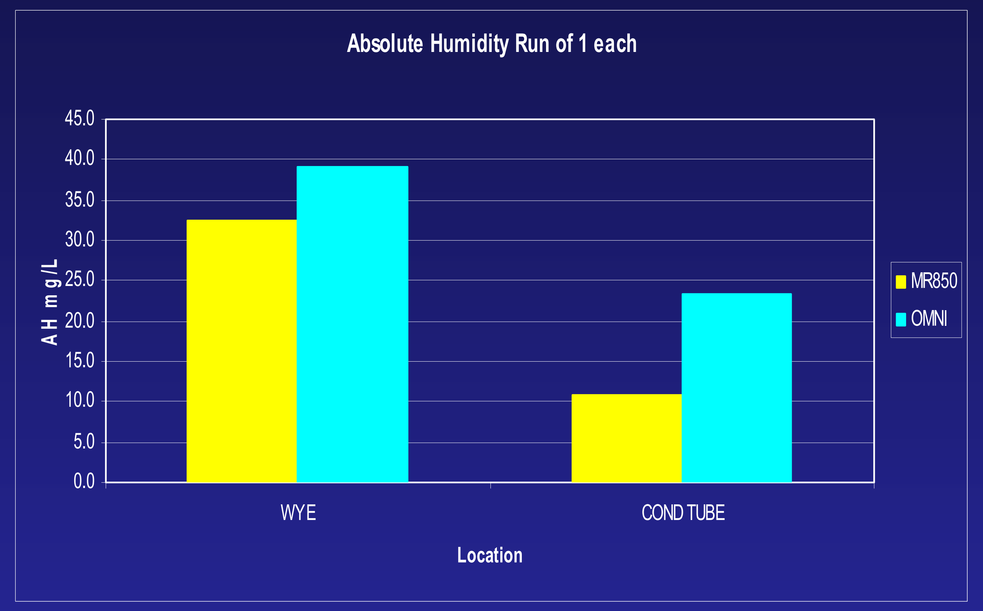
  Where AH = absolute humidity (mg/L); T = temperature in C; and RH = relative humidity (%)

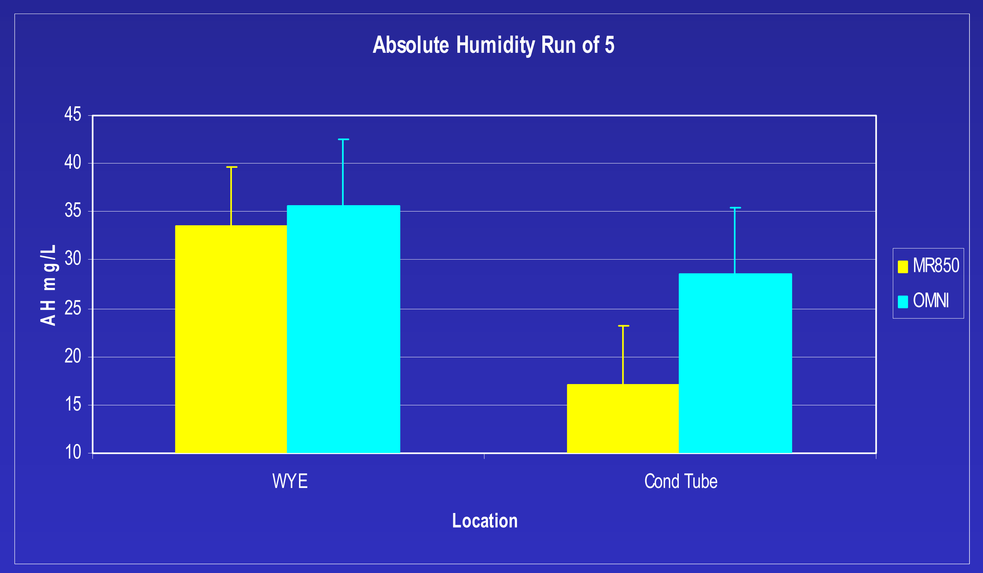


Results

- The MR850 provided an absolute humidity of 32.5 mg/L at the wye (Figure 2). This is above the AARC Clinical Practice Guideline standard[1] of 30 mg/L but just below the ISO[2] and ASTM[3] standards of 33 mg/L .
- The OMNI produced an absolute humidity of 39.1 mg/L at the wye.
- At the distal end of the condensation tube the F & P produced an absolute humidity of 10.7 mg/L while the Hydrate OMNI produced an absolute humidity of 23.4 mg/L.

- The second chart (Figure 3) represents the results of a subsequent series of 5 runs per humidifier type (5 different units per type).
- In this scenario the MR850's produced an absolute humidity in these runs of 33.5 mg/L and 17.1 mg/L at wye and distal end of the condensation tube respectively.
- The hydrate OMNI produced an absolute humidity of 35.7 mg/L and 28.5 mg/L at the wye and distal end of the condensation tube respectively.





Conclusion

- In this bench study the Hydrate OMNI produced more absolute humidity than the F & P MR850 both at the wye and at the distal end of the condensation tube during HFOV. Further study on humidification during HFOV is needed.

References

1. AARC Clinical Practice Guidelines. Respir Care 1992;37:887-890
2. International Orgaganization for Standardization (ISO) 2004.
3. American Society for Testing and Materials (ASTM) 2004.