Mechanical ventilation with heated humidifiers or with heat and moisture exchangers with microbiological filters did not reduce ventilator associated pneumonia in adults

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**Q** Does the method of airway humidification (heat and moisture exchangers [HMEFs] or heated humidifiers [HHs]) affect the incidence of ventilator associated pneumonia (VAP) in adults?

**METHODS**

- **Design:** randomised controlled trial.
- **Allocation:** concealed.
- **Blinding:** blinded (microbiologists confirming VAP).
- **Follow up period:** up to 28 days of mechanical ventilation.
- **Setting:** 5 intensive care units (ICUs) in 2 university affiliated teaching hospitals in France.
- **Patients:** 370 patients > 18 years of age (mean age 55 y, 70% men) who required mechanical ventilation (eg, nasotracheal, orotracheal, or tracheostomy tube) for > 24 hours. Exclusion criteria were previous ventilation for > 24 hours, contraindications to HHs (eg, active tuberculosis) or to HMEFs (eg, haemoptysis or severe hypothermia), admission after cardiac arrest, enrolment in other clinical trials, or early decision to limit active treatment.
- **Intervention:** mechanical ventilation with an HMEF (DAR Hygrobac filter device, Tyco Healthcare/Nellcor, California) changed every 48 hours (n = 186) or with an HH (MR730 device, Fisher and Paykel Healthcare Ltd, New Zealand) (n = 184).
- **Outcomes:** VAP diagnosed based on clinical suspicion > 48 hours after initiation of ventilation and confirmed with microbiological criteria. Secondary outcomes were ICU death, duration of ICU stay, duration of mechanical ventilation (overall and before VAP), tracheostomy, and endotracheal tube occlusion. The study had 80% power to detect a 40% relative reduction in VAP.
- **Patient follow up:** 99.7% (intention to treat analysis).

**MAIN RESULTS**

The HMEF and HH groups did not differ for VAP (table), ICU death (32% v 34%, p = 0.74), duration of ICU stay (21 v 23 d, p = 0.15), duration of mechanical ventilation (14 v 15 d, p = 0.36), duration of ventilation before VAP (8 v 9 d, p = 0.39), tracheostomy (13% v 20%, p = 0.13), or tube occlusion (0.5% v 2.7%, p = 0.12).

**CONCLUSION**

Mechanical ventilation with heated humidifiers or with heat and moisture exchangers with microbiological filters resulted in similar rates of ventilator associated pneumonia.

**Commentary**

Differing diagnoses of VAP, specific patient populations, and inadequate power are some of the limitations of previous research on the effects of humidification devices on VAP. Lacherade et al conducted a large multicentre, adequately powered study involving general ICU patients. Concealed randomisation, full patient follow up, and intention to treat analysis strengthen the study. Limitations reported by the authors include an inability to blind staff to patient treatment.

Specific humidification devices used in this study differed from those used in other studies, as did the outcome measures to establish effect of humidification on endotracheal tube (ETT) patency. Indicators of ETT patency, such as the inner volume of the ETT and resistance to flow, are arguably more specific than reintubation rates related to ETT occlusion. Although HMEFs were routinely changed every 48 hours, it is unclear whether staff initiated changes outside of this time frame, a finding that could have affected VAP and ETT occlusion rates. Specific humidification devices used in this study differed from those used in other studies, as did the outcome measures to establish effect of humidification on endotracheal tube (ETT) patency. Indicators of ETT patency, such as the inner volume of the ETT and resistance to flow, are arguably more specific than reintubation rates related to ETT occlusion. Although HMEFs were routinely changed every 48 hours, it is unclear whether staff initiated changes outside of this time frame, a finding that could have affected VAP and ETT occlusion rates. Specific humidification devices used in this study differed from those used in other studies, as did the outcome measures to establish effect of humidification on endotracheal tube (ETT) patency. Indicators of ETT patency, such as the inner volume of the ETT and resistance to flow, are arguably more specific than reintubation rates related to ETT occlusion. Although HMEFs were routinely changed every 48 hours, it is unclear whether staff initiated changes outside of this time frame, a finding that could have affected VAP and ETT occlusion rates.

Lacherade et al found that HMEFs and HHs were associated with similar rates of VAP in general ICU patients. Therefore, when selecting a humidification device, other factors such as cost, risk of ETT obstruction, potential increased work of breathing because of increased dead space and increased resistance with HMEFs, and effect of minute volume on quality of humidification with HMEFs must be considered. Although VAP rates were not affected by the frequency of HMEF changes, other potential complications may have important effects on patients and warrant further investigation.


Mechanical ventilation with heat and moisture exchangers with microbiological filter (HMEFs) v heated humidifiers (HHs) for adults in the intensive care unit

<table>
<thead>
<tr>
<th>Outcomes at &lt; 28 days</th>
<th>HMEF</th>
<th>HH</th>
<th>RRR (95% CI)</th>
<th>NNT (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilator associated pneumonia</td>
<td>25%</td>
<td>29%</td>
<td>3.6% (−35 to 34)</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

*Abbreviations defined in glossary; RRR, NNT, and CI calculated from control event rate and adjusted odds ratio reported in original article.*