Evaluation of hydrogen peroxide vapor for the inactivation of nosocomial pathogens on porous and non-porous surfaces

Sebastian Lemmen (slemmen@ukaachen.de), Simone Scheithauer, Helga Häfner, Saber Yezli, Michael Mohr, Jonathan Otter (jon.otter@bioquell.com).


1. Background
- Multidrug-resistant (MDR) organisms such as meticillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* (VRE) and MDR-*Acinetobacter baumannii* are important nosocomial pathogens that are difficult to eliminate from the hospital environment.
- We evaluated the efficacy of hydrogen peroxide vapor (HPV), a ‘no-touch’ automated room decontamination system, for the inactivation of a range of pathogens dried onto hard non-porous and porous surfaces in an operating room (OR).

2. Methods
- Stainless steel and cotton carriers containing >4-log viable MRSA, VRE or MDR *A. baumannii* using methods adapted from Otter et al (2009) were placed at four locations in the OR along with seven pouched 6-log *Geobacillus stearothermophilus* spore biological indicators (BIs).
- Unexposed carriers were left outside the room for the duration of the cycle; viable counts were determined from all carriers after the cycle.
- HPV was then used to decontaminate the OR.
- The experiment was repeated three times.

<table>
<thead>
<tr>
<th>Organism</th>
<th>MRSA</th>
<th>VRE</th>
<th>MDR-<em>A. baumannii</em></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of Carrier</strong></td>
<td><strong>Stainless steel</strong></td>
<td><strong>Cotton</strong></td>
<td><strong>Stainless steel</strong></td>
</tr>
<tr>
<td>Mean bacterial count in the working suspension (CFU/mL)</td>
<td>7.3 x 10⁸</td>
<td>7.3 x 10⁸</td>
<td>4.2 x 10⁸</td>
</tr>
<tr>
<td>Mean bacterial count applied on the carriers (CFU/carrier)</td>
<td>7.3 x 10⁶</td>
<td>7.3 x 10⁶</td>
<td>4.2 x 10⁶</td>
</tr>
<tr>
<td>Mean bacterial count on the control carriers at the end of HPV exposure (CFU/carrier)</td>
<td>2.6 x 10⁴</td>
<td>6 x 10⁴</td>
<td>3.1 x 10⁴</td>
</tr>
<tr>
<td>Mean bacterial count on the HPV-exposed carriers at the end of HPV exposure (CFU/carrier)</td>
<td>&lt; 1</td>
<td>&lt; 1</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Mean log reduction due to drying and overnight incubation at ambient environment and/or recovery technique</td>
<td>2.4</td>
<td>2.1</td>
<td>2.3</td>
</tr>
<tr>
<td>Mean log reduction due to HPV exposure</td>
<td>4.4*</td>
<td>4.7*</td>
<td>4.1*</td>
</tr>
</tbody>
</table>

3. Results
- >6-log/carrier of each bacterial strain was applied to each carrier with a recovery of >4-log/carrier (Table 1).
- HPV inactivated all spore BIs (>6-log reduction) and no MRSA, VRE or MDR *A. baumannii* was recovered from the stainless steel and cotton carriers (>4 to >5-log reduction, depending on the starting inoculum).
- HPV was equally effective at all carrier locations.
- It was not possible to compare the efficacy of HPV on stainless steel compared with cotton because no pathogens were recovered.

4. Discussion
- We did not identify any difference in efficacy for microbes dried onto stainless steel or cotton surfaces, indicating that HPV may have a role for the decontamination of both porous and non-porous surfaces, including curtains.
- Other studies have shown that HPV can eliminate pathogens from porous surfaces in hospitals.
- HPV is an effective way to decontaminate clinical areas where contamination with bacterial spores and MDR organisms is suspected.


Conflicts of interest: JO and SY are employed part-time by Bioquell. MM is employed by Schülke. All other authors have no conflicts to declare.