Compatibility of Hydrogen Peroxide Vapor Room Decontamination with Physiological Monitors

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Recently, there has been increased interest in the use of "no-touch" room decontamination systems, including hydrogen peroxide vapor (HPV) systems, of which there are 2 main types. The microcondensation HPV process (Bioquell) is referred to in some articles as a "wet process," although surfaces are not wet to the touch at the end of the decontamination cycle. The vaporized hydrogen peroxide process (Steris) is sometimes referred to as a "dry" process. Some authors have suggested that the microcondensation process may be harmful to sensitive electronic medical equipment. We conducted a retrospective study to assess the compatibility of a microcondensation HPV room decontamination system with physiological monitors in a university-affiliated hospital where HPV has been in continuous use since July 2005.

HPV was implemented for terminal disinfection of rooms vacated by patients with Clostridium difficile infection and other environmentally associated pathogens in July 2005. The total number of times that rooms in intensive care units (ICUs) and non-ICU rooms underwent HPV decontamination from January 2006 to September 2012 was obtained from hospital records. The clinical engineering department database contained information on the number of service calls related to electronic physiological monitors (Phillips Healthcare and Spacelabs Healthcare) that were permanently mounted in all ICU rooms from 2000 through 2004 (before use of HPV) for 2 ICUs and from 2006 through 2010 (during use of HPV) for 4 ICUs. The number of patient-days and discharges in each ICU was obtained from the hospital's information service. The frequency of calls for equipment repair or replacement was expressed as the number of calls per 1,000 patient-days and the number of calls per 1,000 discharges from the ICU. Although HPV decontamination was only performed after discharge of a patient from the ICU, the results were also expressed per 1,000 patient-days to reflect the number of days that the equipment was actually in use. Throughout the study periods, only microcondensation HPV was used for no-touch room decontamination in the ICUs; a quaternary ammonium compound was used for routine disinfection, and bleach was used in rooms of patients with C. difficile infection. Rates were compared using a Z test (MedCalc).

From January 2006 through September 2012, HPV decontamination was performed 1,381 times in 50 rooms located in 4 ICUs (median HPV episodes per room, 26 [range, 15–77]) and a total of 5,085 times in the hospital overall. The number of clinical engineering service calls regarding physiological monitors in the coronary care ICU from 2000 through 2004 (before the use of HPV) was 94 (2.6 calls per 1,000 patient-days; 19.9 calls per 1,000 discharges from the ICU) compared with 50 calls (1.4 calls per 1,000 patient-days; 15.1 calls per 1,000 discharges from the ICU) in the period 2006 through 2010 (P<.001). In a newly renovated surgical ICU, where new monitors were installed in February 2004, the number of physiological monitor service calls in 2004 was 13 (2.9 calls per 1,000 patient-days; 94.9 calls per 1,000 discharges from the ICU) compared with 14 (0.7 calls per 1,000 patient-days; 17.4 calls per 1,000 discharges from the ICU) in the period 2006–2010 (P<.001). In the cardiothoracic ICU, the number of physiological monitor service calls during 2006–2010 was 7 (0.4 calls per 1,000 patient-days; 4.8 calls per 1,000 discharges from the ICU) and 14 (0.4 calls per 1,000 patient-days; 4.9 calls per 1,000 discharges from the ICU) in the medical ICU.

Continuous use of microcondensation HPV room decontamination in our hospital over a period of 8 years provided us with a unique opportunity to assess the compatibility of this process with medical equipment. We found that the rate of clinical engineering service calls for electronic physiological monitors during years when HPV decontamination was performed decreased, rather than increased, compared with call frequency in the 5 years before the introduction of this technology in the hospital. We suspect that this reduction in the rate of service calls after HPV room decontamination was implemented was most likely related to other unidentified factors and was not directly attributable to the use of HPV room decontamination. Data derived from our 8-year experience with use of HPV room decontamination provides convincing evidence that the HPV process does not have deleterious effects on sensitive medical equipment used in ICUs and other patient care areas. The level of equipment compatibility demonstrated by our findings expands upon short-term evaluations of the compatibility of this process with laboratory and medical equipment reported elsewhere (Table 1). French et al also mentioned that the HPV process is particularly useful in decontaminating complex furniture and medical equipment that is difficult to clean manually.

Our study has a number of limitations. Because of the lack of resources in clinical engineering, we were unable to calculate rates of repairs or replacements for all types of electronic equipment used in ICUs and other patient rooms. Although we do not have complete documentation of all service calls for all electronic devices found throughout our facility for items such as televisions, call buttons, intravenous pumps, electric beds, electronic thermometers, and blood pressure cuffs, there have been no noticeable adverse effects after performing HPV decontamination 5,085 times in the past 8 years. Because the study was performed in a single hospital, the number of service calls related to physiological monitors used in our ICUs might not reflect the experience...
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TABLE 1. Results Observed When Various Types of Laboratory and Medical Equipment Were Exposed for Short Time Periods to Microcondensation Hydrogen Peroxide Vapor

<table>
<thead>
<tr>
<th>Study</th>
<th>Setting</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bates et al</td>
<td>Patient rooms</td>
<td>No damage or malfunction to incubators, ventilators, monitoring equipment</td>
</tr>
<tr>
<td>Hall et al</td>
<td>Laboratory</td>
<td>No damage to laboratory equipment</td>
</tr>
<tr>
<td>Hall et al</td>
<td>Laboratory</td>
<td>No damage to surfaces or computer in laboratory (turned on)</td>
</tr>
<tr>
<td>Otter et al</td>
<td>ICU</td>
<td>No problems with or damage to equipment</td>
</tr>
<tr>
<td>EPA</td>
<td>Laboratory</td>
<td>No visual damage or malfunction of stainless steel objects, other metal objects, a circuit breaker and a smoke detector, personal digital assistant, cellular telephone, fax machine, compact disk, digital video disk, and desktop computer and monitor</td>
</tr>
</tbody>
</table>

Passaretti et al ICU and high-risk surgical units No safety, equipment, or ongoing material compatibility problems were reported

NOTE. EPA, environmental protection agency; ICU, intensive care unit.

References