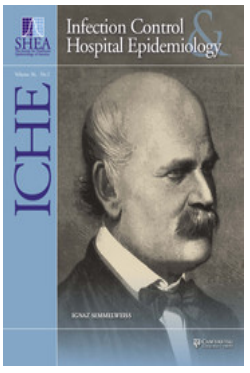

Compatibility of Hydrogen Peroxide Vapor Room Decontamination with Physiological Monitors

John M. Boyce, Nancy L. Havill, Vincent Cianci and Gary Flanagan

Infection Control / Volume 35 / Issue 01 / January 2014, pp 92 - 93
DOI: 10.1086/674388, Published online: 02 January 2015

RESEARCH BRIEF

Compatibility of Hydrogen Peroxide Vapor Room Decontamination with Physiological Monitors

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.[1-3] 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).[4-8] French et al[9] 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

TABLE 1. Results Observed When Various Types of Laboratory and Medical Equipment Were Exposed for Short Time Periods to Microcondensation Hydrogen Peroxide Vapor

Study	Setting	Results
Bates et al[4]	Patient rooms	No damage or malfunction to incubators, ventilators, monitoring equipment
Hall et al[5]	Laboratory	No damage to laboratory equipment
Hall et al[6]	Laboratory	No damage to surfaces or computer in laboratory (turned on)
Otter et al[10]	ICU	No problems with or damage to equipment
EPA[7]	Laboratory	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
Passaretti et al[8]	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.

in other facilities that use monitors from other manufacturers. We analyzed only data regarding equipment compatibility with the microcondensation HPV decontamination process. As a result, our findings should not be extrapolated to other HPV or aerosol hydrogen peroxide systems. Currently, we are unaware of any comparable data on compatibility of other vapor- or aerosol-based systems with electronic equipment used in healthcare facilities. Despite the study limitations, our experience with the microcondensation HPV decontamination process over 8 years provides evidence that this process does not adversely affect electronic equipment used in a hospital setting.

ACKNOWLEDGMENTS

Potential conflicts of interest. J.M.B. is a consultant to Bioquell and has received research support from Bioquell. G.F. is an employee of Bioquell. All other authors report no conflicts of interest relevant to this article. All authors submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest, and the conflicts that the editors consider relevant to this article are disclosed here.

John M. Boyce, MD;[1,2] Nancy L. Havill, MT, CIC;[1] Vincent Cianci;[1] Gary Flanagan[3]

Affiliations: 1. Yale-New Haven Hospital, New Haven, Connecticut; 2. Yale University School of Medicine, New Haven, Connecticut; 3. Bioquell, Horsham, Pennsylvania.

Address correspondence to John M. Boyce, MD, Hospital Epidemiology and Infection Control, Yale-New Haven Hospital, 20 York Street, New Haven, CT 06510 (john.boyce@ynhh.org).

Received June 14, 2013; accepted September 4, 2013; electronically published December 3, 2013.

Infect Control Hosp Epidemiol 2014;35(1):92-93

 0899-823X/2014/3501-0017$15.00. DOI: 10.1086/674388

REFERENCES

1. McDonnell G. Hydrogen peroxide fogging/fumigation. *J Hosp Infect* 2006;62:385–386.
2. Andersen BM. Does "airborne" hydrogen peroxide kill *Mycobacterium tuberculosis*? *J Hosp Infect* 2011;77:81–83.
3. Kahnert A, Seiler P, Stein M, Aze B, McDonnell G, Kaufmann SH. Decontamination with vaporized hydrogen peroxide is effective against *Mycobacterium tuberculosis*. *Lett Appl Microbiol* 2005;40:448–452.
4. Bates CJ, Pearse R. Use of hydrogen peroxide vapour for environmental control during a *Serratia* outbreak in a neonatal intensive care unit. *J Hosp Infect* 2005;61:364–366.
5. Hall L, Otter JA, Chewins J, Wengenack NL. Deactivation of the dimorphic fungi *Histoplasma capsulatum*, *Blastomyces dermatitidis* and *Coccidioides immitis* using hydrogen peroxide vapor. *Med Mycol* 2008;46:189–191.
6. Hall L, Otter JA, Chewins J, Wengenack NL. Use of hydrogen peroxide vapor for deactivation of Mycobacterium tuberculosis in a biological safety cabinet and a room. *J Clin Microbiol* 2007; 45:810–815.
7. Environmental Protection Agency, Office of Research and Development, National Homeland Security Research Center. Compatibility of material and electronic equipment with hydrogen peroxide and chlorine dioxide fumigation. Assessment and evaluation report. EPA 600/R-10/169 2010;1–70.
8. Passaretti CL, Otter JA, Reich NG, et al. An evaluation of environmental decontamination with hydrogen peroxide vapor for reducing the risk of patient acquisition of multidrug-resistant organisms. *Clin Infect Dis* 2013;56:27–35.
9. French GL, Otter JA, Shannon KP, Adams NMT, Watling D, Parks MJ. Tackling contamination of the hospital environment by methicillin-resistant *Staphylococcus aureus* (MRSA): a comparison between conventional terminal cleaning and hydrogen peroxide vapour decontamination. *J Hosp Infect* 2004;57:31–37.
10. Otter JA, Yezli S, Schouten MA, van Zanten AR, Houmes-Zielman G, Nohlmans-Paulssen MK. Hydrogen peroxide vapor decontamination of an intensive care unit to remove environmental reservoirs of multidrug-resistant gram-negative rods during an outbreak. *Am J Infect Control* 2010;38: 754–756.