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Improved Eradication of *Clostridium Difficile* Spores From Toilets of Hospitalized Patients Using an Accelerated Hydrogen Peroxide as the Cleaning Agent

(*BMC Infectious Diseases* 2010, 10:268)

Abstract

Clostridium difficile associated diarrhea (CDAD) is a significant problem in healthcare facilities world-wide. Since 2000 there has been an increase in the rates of *C. difficile* in some health care settings. This increase in CDAD has resulted in significant additional costs to the healthcare system. According to one study, in U.S. hospitals it is estimated that each case of CDAD in a hospital was associated with $3699.00 (USD) in excess healthcare costs and 3.6 extra days of hospitalization. The use of Accelerated Hydrogen Peroxide® (AHP®) in this study shows that it is a useful alternative to bleach where *C. difficile* spores may exist. Unlike most disinfectant technologies, AHP is a very good cleaner, as well as a fast acting bactericidal and virucidal agent which simplifies the cleaning protocol for Environmental Services Staff as only one product needs to be used.

Background

The presence of *C. difficile* spores shed by patients in the environment of healthcare facilities is thought to be a reservoir for the spread of the organism. Reducing *C.difficile* spores from the environment is challenging as the number surface disinfectants with sporicidal activity is limited. Although bleach has been suggested as an efficient means of killing *C. difficile* spores it has a number of workplace safety concerns. The objective this research study was to determine if the presence of *C.difficile* spores in toilets of patients with CDAD could be reduced in non-outbreak conditions when a non-bleach based disinfecting agent that had some sporicidal activity was used for cleaning toilets.

Study

The study incorporated the use of bleach and two Accelerated Hydrogen Peroxide (AHP) based products. The AHP-based products included in the study were a Health Canada DIN registered 3% Stabilized Hydrogen Peroxide formula. The second AHP-based formulation was a Health Canada DIN registered and EPA registered Ready-To-Use 0.5% AHP One-Step disinfectant-cleaner.

Preliminary *in vitro* testing using the two AHP formulations and three concentrations of Bleach was conducted using a simulated-use suspension test method. The results showed that a 0.5% AHP product provided a 2-3 Log kill of *C.difficile* spores with a 1-minute contact time. While not as efficient as the kill achieved for 5000 ppm bleach, this formulation was equivalent to a 1000ppm bleach solution after 1-minute. Further testing compared the efficacy of bleach to the 0.5% AHP formulation using various application methods and found that it and 5000 ppm bleach were not statistically different in the spore killing ability when applied to surfaces when no wiping was performed. The AHP formulation was selected for the intervention study as it had the ability to kill some spores in a short period of time, does not require special PPE and provides a one-step process.

The intervention study included the use of a UV visible marker (UVM) to ensure that cleaning was in fact taking place. The UVM data indicated a 60% compliance rate with the housekeeping cleaning policy highlighting that despite the twice per day cleaning requirement, 40% of the time this was not being achieved. The frequency with which the cleaning protocols were not followed highlights the importance of using an auditing tool other than the currently accepted benchmark of "visibly clean" to ensure cleaning has taken place. Daily monitoring of the patient's toilet for *C. difficile* spores was conducted to provide a direct assessment of the impact of the cleaning agent on the spore removal/killing.

Conclusion

The study was the first to provide data that a one-step cleaning process using AHP can significantly reduce the load of *C.difficile* spores in the toilets of patients with CDAD during non-outbreak conditions. The results of the study demonstrated that the AHP intervention results in spore levels nearly equivalent to previously published studies using a 5000 ppm bleach solution and without the workplace safety concerns. The evidence from this study shows that the AHP formulation may be a useful alternative to bleach. Suspension test results show that AHP is able to reduce the spore concentration by 2-3 Logs after 1 minute and when used in the spritz and wipe application there was no statistical significance between the use of it and a 5000ppm bleach solution. In conclusion, the data demonstrated that the use of an agent with some sporicidal activity for cleaning resulted in significantly reduced *C. difficile* spore levels in toilets of patients with CDAD during non-outbreak conditions. Infection transmission within healthcare will remain problematic if the role of housekeeping remains undervalued and if they are not provided with adequate audit tools such as UVM to ensure sustained cleaning compliance.

Implications for AHP

AHP Disinfectants are One-Step Disinfectant Cleaners

•AHP has proven cleaning efficiency resulting in lower costs and faster results as well as added confidence that disinfection can occur

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•The Oxivir TB formulation has also been proven to kill C. *diff* spores by > 2 Log after 1 minute exposure [i]

AHP Disinfectants provide the perfect balance between safety and efficacy

•AHP is designed to be easier on employees and occupants resulting in protocol compliance

•AHP provides a HMIS rating of "0", meaning it has been proven to be non-toxic, non-irritating to eyes and skin and non-skin sensitizing and does not require the use of personal protective equipment to handle

AHP Disinfectants are environmentally sustainable

•AHP's active ingredient, hydrogen peroxide, breaks down into water and oxygen leaving no active residues

•AHP is formulated to ensure that it will not negatively impact indoor air quality and has been approved as an asthma-safe product

AHP Disinfectants have realistic contact times

•Short contact times ensure surfaces remain wet for the required contact time, providing comfort and confidence that disinfection has occurred

•AHP has been proven through peer reviewed studies to reduce HAIs

AHP Disinfectants are compatible

•AHP formulations are tested to ensure compatibility that preserve your investments in equipment, furniture and building surfaces by reducing corrosion and wear

[i] The Oxivir TB Formulation of Accelerated Hydrogen Peroxide (AHP) is Effective for Killing Clostridium Difficile Spores on Toilet Seat Surfaces. CJIC Vol 22, No. 1, Spring 2007, pg 49