Efficacy of Different Cleaning and Disinfection Methods against Clostridium difficile Spores: Importance of Physical Removal versus Sporicidal Inactivation

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Background:

*Clostridium difficile* (C. diff) certainly remains one of the most important causes of healthcare-associated diarrhea. Statistics published by the CDC indicate the number of deaths from *Clostridium difficile* Infection (CDI) have raised from 3000 during 1999-2000 to 14,000 during 2006-2007. Prevention of transmission can then be divided into two categories: preventing horizontal transmission, to minimize exposure; and by decreasing the risk factors for patients to develop *C. difficile* infection (CDI), if exposure has occurred. The primary mode of transmission resulting in disease is person-to-person spread through the fecal-oral route whether through contact with contaminated hands, contaminated environment or contact with *C. diff* positive patients. The hands of healthcare workers (HCW), transiently contaminated with *C. difficile* spores are probably the main means by which the organism is spread during non-outbreak periods, but certainly it is believed that environmental contamination also has an important role in transmission within healthcare settings. Additionally, patient care equipment such as electronic rectal thermometers or inadequately cleaned commodes or bedpans that have been shared between patients has been found to contribute to transmission. However, we must also consider other underlying risk factors for disease such as; age, duration of hospitalization, exposure to antimicrobial agents, cancer chemotherapy, immunosuppression, gastrointestinal surgery or manipulation of the gastrointestinal tract such as a feeding tube, and while controversial, breaches in the protective effect of stomach acid resulting from the use of acid suppressing medications also seems to increase risk.

Situation:

Current SHEA\(^1\) and APIC guidelines for managing *Clostridium difficile*\(^2\) in healthcare facilities agree that the efficacy of cleaning is critical to the success of decontamination in general and that cleaning and disinfection activities using the physical motions of cleaning and use of a routine germicide removes and dilutes spore concentration and is acceptable in the absence of an outbreak. Further, user acceptability and material compatibility (corrosion and pitting of equipment and other surfaces over time) of the disinfectant being used is key issue.

While there is an understanding that a contaminated environment certainly plays some role in transmission and acquisition, the true contribution remains controversial. The level of environmental spore contamination has been quantitated by several studies to be at levels below 1 Log\(_{10}\) (i.e. <10 colony-forming units), yet we have not studied or qualified the best method with which to clean surfaces contaminated with *C. diff* spores. Dr. Rutala and his research team in this study assessed the
relative importance of physical removal of C.diff spores using both sporicidal and non-sporicidal cleaning and disinfecting agents.

Results of the Study:

The study compared two non-sporicidal agents and four sporicidal agents to determine the effectiveness of different cleaning methods and agents in reducing spore load on a Formica surface. The end result was that any method (regardless of sporicidal status of the agent used) resulted in approximately a 3 Log$_{10}$ reduction of C. difficile spores and therefore, would be sufficient to remove the expected level of contamination. Wiping surfaces twice as compared to wiping the surface once lead to improved removal of C. difficile spores. Sporicidal agents provided a greater than 3 Log$_{10}$ reduction depending on formulation and/or application with the most commonly used sporicidal bleach wipe showing just under a 4 Log$_{10}$ reduction.

Conclusions:

Management of Clostridium difficile requires a multifaceted approach. Current infection prevention and control guidelines agree that thorough cleaning of environmental surfaces is of utmost importance as a way of removing a substantial number of spores from the surface. While this study concluded that the use of a sporicidal agent to wipe the surface provides the highest level of removal and inactivation of spores, the non-sporicidal agents were shown to reduce the spore count by 3 Log$_{10}$ which is considerably more than the expected 1 Log$_{10}$ level of C.diff contamination reported to be found in the environment.

While a product’s ability to kill is important, we must be realistic in assessing the resources, both time and human, as well as how products are utilized by the environmental services department. A chemistry that has proven cleaning efficacy and the ability to physically remove spores will enhance facilities’ success in eradicating spores.

Implications for the AHP Technology:

AHP® Technology has gained a reputation for being one of the most effective and safest disinfection technologies on the market. AHP® products are proven effective cleaners (in accordance to CGSB 2:16-87 and ASTM 4488-89, 5343 test methods) and therefore can be used as both the cleaner (lifts and removes soil load and pathogens such as C. difficile spores) and disinfectant in accordance with current Infection Control Guidelines for cleaning and disinfection of C. difficile Isolation Rooms. As both a fast acting Hospital Grade Disinfectant and Cleaner, this simplifies the cleaning protocol for Environmental Services Staff, as only one product needs to be used.