

UV-visible marker confirms that environmental persistence of *Clostridium difficile* spores in toilets of patients with *C. difficile*-associated diarrhea is associated with lack of compliance with cleaning protocol

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BACKGROUND

Environmental survival of antibiotic resistant organisms has been suspected to play a role in nosocomial transmission of pathogens. When patients are diagnosed with infections, they are put on isolation precautions and for pathogens such as *C. difficile*, the housekeeping cleaning protocols are enhanced to reduce the environmental load and potential for cross contamination and as a result the risk of acquiring nosocomial infections. In this study an ultraviolet visible marker (UVM) was used to assess the cleaning compliance of housekeeping staff for toilets in a healthcare setting. The aim of this project was to determine if a UVM could be used to determine the compliance of housekeeping staff with the twice daily cleaning protocols for patients who have been placed on isolation precautions because of CDAD (*C. difficile* associated diarrhea).

METHODS

The UVM used in this study was a lotion that was applied to the toilets of patients who were on isolation precautions due to *Clostridium difficile*-associated diarrhea (CDAD) as well as for patients who were not on isolation precautions. Cleaning was visually scored using a numeric system where 0, 1, 2, and 3 represented; no, light, moderate or heavy residual UVM. Rodac plates

containing CDMN (*Clostridium difficile* moxalactam, norfloxacin) selective agar was used to test for the presence of *C. difficile* on the surfaces of patient's toilets. A visual score for residual marker was used; 3 represented heavy fluorescence, 2 represented moderate fluorescence, 1 represented light fluorescence, and 0 represented no fluorescence. Using this numeric scoring system based on visual inspection, an average cleaning score could be determined.

Culture for *C. difficile* from patient-used toilets:

For each toilet (or commode) the agar surface of one plate was sequentially pressed onto all surfaces that should be cleaned as part of regular toilet cleaning (the armrest, underside of the toilet lid, the toilet seat surface, the toilet seat underside, and the inside rim of the upper portion of the toilet bowl).

Housekeeping standard cleaning protocol:

Once daily, the toilets and high-contact surfaces were cleaned and disinfected using PerDiem® (3% stabilized hydrogen peroxide) at a 1:256 use-dilution. The cleaning protocol consisted of spraying the SHP solution to wet all of the surfaces of the toilet and left for a contact time of about three minutes while other parts of the bathroom were cleaned. The toilet was wiped with a cloth rag that had been wet with the same cleaning

agent. The cleaning rags were used for one patient toilet only and then were sent for laundering.

Patients enrolled in Arm 1 of the study had laboratory confirmed CDAD, and were on isolation precautions. The toilets used by these patients were inoculated with UVM each weekday and then visually inspected the next day to determine if the UVM had been removed. Toilets were also sampled each weekday for the presence of *C. difficile* spores. The use-dilution of the 3% SHP cleaning agent was 1:64 and cleaning was performed twice per day.

Patients enrolled in Arm 2 of the study did not have CDAD and they were not on isolation precautions. The toilets used by these patients were inoculated with UVM each weekday and then visually inspected the next day to determine if the UVM had been removed. Toilets were also sampled each weekday for the presence of detectable *C. difficile* spores. The use-dilution of the 3% SHP cleaning agent was 1:256, and toilet cleaning was performed once per day.

RESULTS

Despite twice daily cleaning for the toilets of patients who were on CDAD isolation precautions, the average cleaning score was 1.23 whereas the average cleaning score for toilets of patients not on isolation precautions was 0.9. Even with optimal cleaning (UVM score of 0) *C. difficile* was detected from 33% of the samples taken from toilets of patients with CDAD and a 4% detection in toilet samples from patients who had diarrhea not due to CDAD.

CONCLUSION

UVM is valuable for monitoring the compliance of toilet cleaning protocol by housekeeping staff. In addition to providing good physical cleaning action, agents with some sporicidal activity against *C. difficile* may be needed to effectively reduce the environmental reservoir.

Furthermore, UVM monitoring would provide a valuable control for clinical evaluations of intervention agents and is recommended to be used on a routine basis as part of the quality assurance program for housekeeping throughout a healthcare facility. Furthermore, without the use of an agent containing some activity against *C. difficile* spores, the physical action of cleaning alone cannot be relied upon to effectively eradicate this organism from the toilets of patients who are shedding this type of spore.

REFERENCES

Alfa M.J., Dueck C., Olson N., DeGagne P., Papetti S., Wald A., Lo E. and Harding G. (2008). UV-visible marker confirms that environmental persistence of *Clostridium difficile* spores in toilets of patients with *C. difficile*-associated diarrhea is associated with lack of compliance with cleaning protocol. BMC Infectious Diseases, 8:64.