ANTIMICROBIAL RESISTANCE & INFECTION CONTROL

RESEARCH Open Access

Biocidal activity of metalloacid-coated surfaces against multidrug-resistant microorganisms

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Abstract

Background: The antimicrobial effects of a coating of molybdenum trioxide (MoO_3) has been recently described. The metalloacid material produces oxonium ions (H_3O^+), which creates an acidic pH that is an effective, non specific antimicrobial. We determined the *in vitro* antimicrobial activity of molybdenum trioxide metalloacid-coated surfaces.

Methods: Metalloacid-coated and non-coated (control) surfaces were contaminated by exposing them for 15 minutes to microbial suspensions containing 10^5 cfu/mL. Eleven microorganisms responsible for nosocomial infections were tested: two *Staphylococcus aureus* strains (the hetero-vancomycin intermediate MRSA Mu50 strain and a ST80-PVL-producing MRSA strain); a vancomycin-resistant *van*A *Enterococcus faecium* strain; three extended-spectrum beta-lactamase-producing *Enterobacteriaceae* strains; a MBL-producing *Pseudomonas aeruginosa* strain; a multidrug-resistant *Acinetobacter baumannii* strain; a toxin-producing *Clostridium difficile* strain; and two fungi (*Candida albicans* and *Aspergillus fumigatus*). The assay tested the ability of the coated surfaces to kill microorganisms.

Results: Against all non-sporulating microorganisms tested, metalloacid-coated surfaces exhibited significant antimicrobial activity relative to that of the control surfaces within two to six hours after contact with the microorganisms ($p < 0.001$). Microorganism survival on the coated surfaces was greatly impaired, whereas microorganism survival on control surfaces remained substantial.

Conclusions: We suggest that, facing the continuing shedding of microorganisms in the vicinity of colonized or infected patients, the continuous biocidal effect of hydroxonium oxides against multidrug-resistant microorganisms may help limit environmental contamination between consecutive cleaning procedures.

Keywords: Metalloacid-coated surface, Biocidal effect, Infection control

Background

Nosocomial infections are a major cause of patient morbidity and mortality. Those associated with contaminated surfaces and the inadequate hand hygiene of healthcare workers (HCWs) are avoidable by cleaning and/or disinfecting environmental surfaces and by appropriate hygiene practices [1-4]. The transmission of microorganisms responsible for contaminated surface-associated nosocomial infections is well understood. Briefly, patients and HCWs carry and shed microorganisms around them. Surviving microorganisms contaminate near-patient items, which then act as reservoirs for microbial pathogens and become sources of contamination for the hands of HCWs and of colonization for new patients. Microbial colonization of surfaces can be restricted by cleaning procedures that employ effective chemical products. Cleaning reduces the prevalence of microorganisms in the environment and has been demonstrated to be a key-measure in the control of outbreaks associated with methicillin-resistant *S. aureus* (MRSA), vancomycin-resistant enterococci (VRE) and *A. baumannii* [1-7].

In fact, the continuing shedding of microorganisms between consecutive cleansing interventions, and the

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