Efficacy of dilute bleach solutions and an electrochemically activated saline solution containing hypochlorous acid for disinfection of methicillin-resistant *Staphylococcus aureus* on skin

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ABSTRACT

**Background:** Dilute bleach baths are commonly used as part of *Staphylococcus aureus* decolonization regimens in children, but limited data are available on the microbiological efficacy and optimal concentrations of bleach solutions on skin. We used a pigskin model to examine the effectiveness of various concentrations of dilute bleach solution for disinfection of methicillin-resistant *S. aureus* (MRSA) on skin. In addition, we tested the hypothesis that an electrochemically activated hypochlorous acid solution (Vashe) that is safe for application on skin would be more effective. **Methods:** In vitro log reductions of 4 strains of MRSA inoculated onto polystyrene surfaces or irradiated pigskin were compared for household bleach solutions at 1.3 μL/mL, 2.5μL/mL, and 4.0μL/mL and Vashe (0.025% hypochlorous acid) after 15 minutes of incubation. The 1.3 μL/mL concentration is equivalent to 1 teaspoon per gallon of water as recommended in current Infectious Diseases Society of America (IDSA) guidelines for decolonization protocols. On polystyrene surfaces, the impact of organic material on efficacy of the solutions was tested by comparing killing of MRSA with or without a simulated organic load consisting of bovine serum albumin, tryptone, and mucin. **Results:** In comparison to controls, the 1.3 μL/mL bleach solution reduced levels of MRSA by an average of 1.8 and 1.3 logs on polystyrene and pigskin, respectively. On both surfaces, significantly greater reductions were achieved by the higher concentrations of bleach solution (2.5 to 4 logs on polystyrene and 1.8 to 2.1 logs on pigskin; P<0.03) and by Vashe (4 logs on polystyrene and 2.6 logs on pigskin; P<0.0001). On polystyrene, the presence of organic load markedly reduced killing of MRSA by bleach solutions and Vashe (<1 log reduction for all test solutions). **Conclusion:** Dilute bleach solutions were effective in reducing levels of MRSA on polystyrene surfaces and on pigskin, but Vashe or higher concentrations of bleach solution may be more effective than the bleach concentration recommended in current IDSA guidelines.

**Background**

- Dilute bleach baths are commonly used as part of *S. aureus* decolonization regimens in children
- However, limited data are available on the microbiological efficacy and optimal concentrations of bleach solutions on skin
- Electrochemically activated saline solutions containing hypochlorous acid and free radicals are a potential alternative to bleach, but have not been studied for disinfection of *S. aureus* on skin

**Methods**

**In vitro testing on polystyrene surfaces**
- Polystyrene surfaces were inoculated with ~5 log10 CFU of MRSA with or without simulated organic load (bovine serum albumin, tryptone, and mucin) with dwell time of 6 or 15 minutes
- MRSA test strains (N=4): ATCC 43300 and 3 clinical MRSA isolates including a USA300 community-associated isolate
- Test solutions: bleach at concentrations of 1.3 μL/mL, 2.5μL/mL, or 4.0 μL/mL, Vashe® (PuriCore, Malvern, PA), an electrochemically activated saline solution approved for wound care, and PBS (control)
- Neutralizer: Dey-Engley neutralizer
- Log reductions calculated versus PBS controls
- The 1.3 μL/mL concentration is equivalent to 1 teaspoon per gallon of water as recommended in current IDSA guidelines

**Results**

- In comparison to controls, the 1.3 μL/mL bleach solution reduced levels of MRSA by an average of 1.8 and 1.3 logs on polystyrene and pigskin, respectively (Fig. 2 and 3)
- On both surfaces, significantly greater reductions were achieved by the higher concentrations of bleach solution (2.5 to 4 logs on polystyrene and 1.8 to 2.1 logs on pigskin; P<0.03) and by Vashe (4 logs on polystyrene and 2.6 logs on pigskin; P<0.0001)
- On polystyrene, the presence of organic load reduced killing of MRSA by bleach solutions and Vashe (<1 log reduction for all test solutions)

**Discussion**

- Dilute bleach solutions were effective in reducing levels of MRSA on polystyrene surfaces and on pigskin, but Vashe® or higher concentrations of bleach solution may be more effective than the bleach concentration recommended in current IDSA guidelines
- Additional studies are needed to examine the tolerability and efficacy of Vashe and higher concentrations of bleach solution in MRSA colonized patients

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