Poster

Effect of disinfectants used in clinical facilities on the induction of the SOS response and mutation frequency in Escherichia coli

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ABSTRACT

Motivation: The development of antibiotic resistance is one of the mechanism used to study adaptive evolution. Antibiotics not only select for preexisting resistant strains in a population, but they can also promote the appearance of resistant strains (1, 2). Antibiotics at high concentrations can be lethal to bacteria, but it has been shown that sub-inhibitory concentrations of some antibiotics can stimulate horizontal transfer of DNA and mutation in different chromosomal loci (1, 3). These antibiotics can increase the mutation rate through several mechanisms, such as oxidative stress and the SOS response, which is triggered by DNA damage (2, 3). In this context, we wanted to determine if commonly-used disinfectants also promote mutation.

Methods: The disinfectants used were ethanol, sodium hypochlorite, chlorhexidine, silver nitrate, benzalkonium chloride, triclosan and povidone-iodine complex. The E.coli strain used was IBDS1, which includes a tetracycline gene regulated by the cI (Ind-) repressor gene, that allows us to measure the mutation rate.

To study the effect of these disinfectants, the strain IBDS1 was tested with a window of concentrations very close to the minimum inhibitory concentration (MIC) by evaluating the appearance of mutants resistant to rifampicin or tetracycline (3). To determine if this effect could be linked to the induction of the SOS system, we used a plasmid which expresses the "Green Fluorescence Protein" (GFP) under the control of the promoter of the recA gene to detect when the SOS system is activated by measuring fluorescence.

Results: Three of the disinfectants tested increased mutation frequency. Concentrations of 0.013 µg/ml and 0.026 µg/ml of NaClO (1/4x CMI y 1/2x MIC) increased the mutation frequency approximatly 4 fold and 0.5 µg/ml of clorhexidine (1/4x MIC) and 0.125 µg/ml of triclosan (1/4x MIC) 3 fold, approximately. In relation to the SOS system, none of the concentrations tested induced the SOS response.

Conclusions: These results show that certain concentrations of sodium hypochlorite, chlorhexidine and triclosan increase the mutation frequency and therefore may facilitate the appearance of resistant strains, although it appears that this mutagenic effect is not related to the induction of the SOS system. Therefore, it would be interesting to study whether this mutagenic effects is due to the reactive oxygen species (ROS) produced by disinfectants.

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