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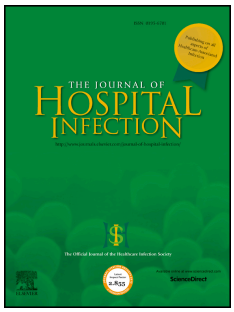

Role of silver nitrate in the efficacy of hydrogen peroxide aerial decontamination systems

Kirat singh, PhD

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Role of silver nitrate in the efficacy of hydrogen peroxide aerial decontamination systems.

Sir,

I note with interest the May 2016 article by S. Ali *et al*. "Efficacy of two hydrogen peroxide vapour aerial decontamination systems for enhanced disinfection of meticillin-resistant Staphylococcus aureus, Klebsiella pneumoniae and Clostridium difficile in single isolation rooms."[1]

The two systems compared in this study use very different concentrations of hydrogen peroxide, and yet showed almost indistinguishable efficacy in these tests.

This would lead to the conclusion that the bactericidal and sporicidal efficacy of H_2O_2 is independent of concentration, which seems improbable – indeed, previous comparative evaluations of a high-concentration (30%) hydrogen peroxide system (Bioquell) with a low-concentration (5%) hydrogen peroxide system (ASP Glosair) by Fu *et al.*[2] Holmdahl *et al*.[3] and Beswick *et al.*[4] have demonstrated that the low-concentration fogging only achieved log reduction factors (LRF) of between 2 and 4, which was much smaller that the LRF of 6 generally achieved with the higher hydrogen peroxide concentration.

I would suggest that the unexpectedly high efficacy of the 4.9% hydrogen peroxide system evaluated by *S. Ali et al.*[1] may be attributable to the relatively high level of silver nitrate in the proprietary Deproxin solution. The Deproxin MSDS[5] states: "CAS: 7761-88-8 Silver <0.2% EINECS: 231-853-9". While "Silver" is given as the description, the CAS and EINECS numbers show that this is in the form of silver nitrate. In terms of ppm, 0.2% equates to 2000ppm. By contrast, the ASP Glosair system evaluated in the three papers mentioned above contained "<50ppm silver nitrate". The solution used by *S. Ali et al.*[1] thus apparently contained around forty times more "silver" than solutions used in systems previously evaluated.

Even at 2000ppm, the silver nitrate in Deproxin is considerably less concentrated than the hydrogen peroxide, by a factor of 25. (0.2% $AgNO_3$: 4.9%H_2O_2) However, there is an important difference in the mode of distribution for these two active ingredients that may tend to preferentially concentrate the silver nitrate in the vicinity of the biological indicators. The hydrogen peroxide is volatile and unstable, and as the fog droplets evaporate, it is distributed throughout the whole volume of the room (about 60m^3 in the example given), where the concentration then drops substantially with elapsed time as it spontaneously decays to oxygen and water. The silver nitrate however is not at all volatile, and is persistent.

The final distribution of the silver nitrate is hard to predict, but it may be assumed that much of it eventually drops to the floor or other horizontal surfaces in the room, either as solid particles or as droplets of solution that have been concentrated by partial evaporation. In the tests performed by *S. Ali et al.,* biological indicators(BIs) were placed in horizontal, upwards facing orientation. If these BIs became saturated with a film of Deproxin solution from the fogging process, it can be expected that as the water evaporated during the "deactivation" cycle, the concentration of the silver nitrate would rise from the initial figure of around 2000ppm to substantially higher levels. It is of note that according to S.R.K. Pandian *et al.*[6] the MIC (Minimum Inhibitory Concentration) of silver nitrate for the spore-forming *Bacillus licheniformis* is only 5m*M*, which is equivalent to 850ppm.