EVALUATION OF NEBULIZED AERIAL DISINFECTANTS IN OPERATING ROOMS

Thesis
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INTRODUCTION

Operating rooms are a high risk area for both patients and medical staff; air-quality management is important so that such environments are ensured to be free of airborne infectious agents. Airborne bacteria have a considerable impact on infection during surgery. When the levels of airborne bacteria are reduced in operating rooms (OR), contamination of wounds is substantially reduced. The most frequently isolated microorganisms were methicillin resistant staphylococcus aureus (MRSA) and Acinetobacter baumannii, suggesting that airborne viable particles in operating theatres can be a significant risk factor for the development of nosocomial infections. In order to reduce bio-aerosol loads in indoor environments, certain control measures can be followed **(*Padma et al., 2008*).**

Environmental infection control and ventilation measures for OR include maintenance of positive-pressure ventilation with respect to corridors and adjacent areas, maintenance of ≥15 air change per hour(ACH), of which ≥3 ACH should be fresh air, filtration of all recirculated and fresh air through the appropriate filters, providing 90% efficiency (dust-spot testing) at a minimum, in rooms not engineered for horizontal laminar airflow, introduction of air at the ceiling and exhaust air near the floor, not to use ultraviolet (UV) lights to prevent surgical-site infections and keeping operating room doors closed except for the passage of equipment, personnel, and patients and limitation of entry to essential personnel **(*Sehulster and Raymond, 2003*).**

There is an increasing body of evidence that cleaning or disinfection of the environment can reduce transmission of healthcare-associated pathogens. Beca-use routine cleaning of equipment items and other high-touch surfaces does not always remove pathogens from contaminated surfaces, improved methods of disinfecting the hospital environment are needed ***(Boyce, 2007).***

Unlike earlier fogging techniques that aero-solized relatively large particles of disinfectant, vapor decontamination methods deliver disinfectants in the form of a vapor (or gas) that is completely dispersed throughout the enclosed space. Formaldehyde and chlorine dioxide vapors are effective in eradicating microorganisms, but their use is associated with potentially toxic end products that require special disposal techniques. In contrast, vapor-phase hydrogen peroxide (i.e., hydrogen peroxide vapor) is catalytically converted to water and oxygen, leaving no harmful by-products **(*Boyce, 2009*).**

Gaseous chlorine dioxide is not mutagenic or carcinogenic in humans. They have a broad spectrum of antimicrobial activity, do not leave toxic residues, are unaffected by water hardness, are inexpensive and fast acting**.** The exact mechanism by which free chlorine destroys microorganisms has not been elucidated. Inactivation by chlorine can result from a number of factors: oxidation of sulfhydryl enzymes and amino acids; ring chlorination of amino acids; loss of intracellular contents; decreased uptake of nutrients; inhibition of protein synthesis; decreased oxygen uptake; oxidation of respiratory components; decreased adenosine triphosphate production; breaks in DNA and depressed DNA synthesis **(*Rutala and Weber, 2008*).**

Hydrogen peroxide vapor (HPV) is a sporicidal and mycobactericidal vapor-phase method for the decontamination of surfaces and medical equipment. HPV has been shown to inactive several nosocomial pathogens in situ, but no in vitro efficacy data are available for common nosocomial pathogens **(*Otter and French, 2009*).** Hydrogen peroxide acts as an oxidant whose hydroxyl free radicals kill a wide range of microorganisms by attacking essential cell components, which include lipids, proteins, and DNA. This compound does have sporicidal activity at high concentrations and prolonged contact times and is widely used as a biocide. The value of stabilized hydrogen peroxide as an environmentally friendly cleaning agent has been reported, although it can be corrosive to aluminum, copper, brass, or zinc ***(Alfa and Jackson, 2001).***

Glutaraldehyde is a saturated dialdehyde that has gained wide acceptance as a high-level disinfectant and chemical sterilant. The biocidal activity of glutaraldehyde results from its alkylation of sulfhydryl, hydroxyl, carboxyl, and amino groups of microorganisms, which alters RNA, DNA, and protein synthesis**.** Vaporized Peracetic acid will inactivate gram-positive and gram-negative bacteria, fungi, and yeasts in <5min at <100ppm. Only limited information is available regarding the mechanism of action of peracetic acid, but it is thought to function as other oxidizing agents, i.e., it denatures proteins, disrupts cell wall permeability, and oxidizes sulfhydral and sulfur bonds in proteins, enzymes, and other metabolites **(*Rutala and Weber, 2008*)**.

AIM OF THE WORK

The aim of this work is to evaluate the most commercially used nebulized disinfectants available in the Egyptian market for their efficiency in OR environmental disinfection.