Papers y estudios sobre los beneficios de la utilización de Dióxido de Cloro en Hospitales e Instituciones de Salud.

Protective effect of low-concentration chlorine dioxide gas against influenza A virus infection.

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Influenza virus infection is one of the major causes of human morbidity and mortality. Between humans, this virus spreads mostly via aerosols excreted from the respiratory system. Current means of prevention of influenza virus infection are not entirely satisfactory because of their limited efficacy. Safe and effective preventive measures against pandemic influenza are greatly needed. We demonstrate that infection of mice induced by aerosols of influenza A virus was prevented by chlorine dioxide (ClO(2)) gas at an extremely low concentration (below the long-term permissible exposure level to humans, namely 0.1 p.p.m.). Mice in semi-closed cages were exposed to aerosols of influenza A virus (1 LD(50)) and ClO(2) gas (0.03 p.p.m.) simultaneously for 15 min. Three days after exposure, pulmonary virus titre (TCID(50)) was 10(2.6+/-1.5) in five mice treated with ClO(2), whilst it was 10(6.7+/-0.2) in five mice that had not been treated (P=0.003). Cumulative mortality after 16 days was 0/10 mice treated with ClO(2) and 7/10 mice that had not been treated (P=0.002). In in vitro experiments, ClO(2) denatured viral envelope proteins (haemagglutinin and neuraminidase) that are indispensable for infectivity of the virus, and abolished infectivity. Taken together, we conclude that ClO(2) gas is effective at preventing aerosol-induced influenza virus infection in mice by denaturing viral envelope proteins at a concentration well below the permissible exposure level to humans. ClO(2) gas could therefore be useful as a preventive means against influenza in places of human activity without necessitating evacuation.

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Safety and efficacy of chlorine dioxide for Legionella control in a hospital water system.

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In a 30-month prospective study, we evaluated the efficacy of chlorine dioxide to control Legionella organisms in a water distribution system of a hospital with 364 patient beds and 74 skilled nursing beds. The number of hot water specimens positive for Legionella organisms decreased from 12 (60%) of 20 to 2 (10%) of 20. An extended time (18 months) was needed to achieve a significant reduction in the rate of Legionella positivity among hot water specimens. At the time of writing, no cases of hospital-acquired Legionnaires disease have been detected at the hospital since the chlorine dioxide system was installed in January 2003. Use of chlorine dioxide was safe, based on Environmental Protection Agency limits regarding maximum concentrations of chlorine dioxide and chlorite.

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A 17-month evaluation of a chlorine dioxide water treatment system to control Legionella species in a hospital water supply.

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OBJECTIVE: To assess the safety and efficacy of a chlorine dioxide water treatment system in controlling Legionella in a hospital water supply. DESIGN: For 17 months following installation of the system, we performed regular water cultures throughout the building, assessed chlorine dioxide and chlorite levels, and monitored metal corrosion. RESULTS: Sites that grew Legionella species

decreased from 41% at baseline to 4% (P = .001). L. anisa was the only species recovered and it was found in samples of both hot and cold water. Levels of chlorine dioxide and chlorite were below Environmental Protection Agency (EPA) limits for these chemicals in potable water. Further, enhanced carbon filtration effectively removed the chemicals, even at chlorine dioxide levels of more than twice what was used to treat the water. After 9 months, corrosion of copper test strips exposed to the chlorine dioxide was not higher than that of control strips. During the evaluation period, there were no cases of nosocomial Legionella in the building with the system, whereas there was one case in another building. CONCLUSIONS: Our results indicate that operation of a chlorine dioxide system effectively removed Legionella species from a hospital water supply. Furthermore, we found that the system was safe, as levels of chlorine dioxide and chlorite were below EPA limits. The system did not appear to cause increased corrosion of copper pipes. Our results indicate that chlorine dioxide may hold promise as a solution to the problem of Legionella contamination of hospital water supplies.

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Endoscope disinfection using chlorine dioxide in an automated washer-disinfector.

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Although 2% glutaraldehyde is often the first-line agent for endoscopic disinfection, its adverse reactions are common among staff and it is less effective against certain mycobacteria and spore-bearing bacteria. Chlorine dioxide is a possible alternative and an automated washer-disinfector fitted with this agent is currently available. This study was conducted to evaluate the effectiveness of chlorine dioxide in endoscopic disinfection after upper gastrointestinal examination. In vitro microbicidal properties of chlorine dioxide solutions were examined at high (600 ppm) and low (30 ppm) concentrations against various microbes including Pseudomonas aeruginosa, Helicobacter pylori, Mycobacterium avium-intracellulare and Bacillus subtilis in the presence

or absence of bovine serum albumin (BSA). Immediately following endoscopic procedures and after application to the automated reprocessor incorporating chlorine dioxide at 30 ppm for 5 min, endoscopic contamination with infectious agents, blood, H. pylori ureA gene DNA and HCV-RNA was assessed by cultivation, sensitive test tape, polymerase chain reaction (PCR) and reverse transcriptase-PCR analysis, respectively. Chlorine dioxide at 30 ppm has equivalent microbicidal activity against most microbes and faster antimicrobial effects on M. avium-intracellulare and B. subtilis compared with 2% glutaraldehyde, but contamination with BSA affected the microbicidal properties of chlorine dioxide. Endoscopic contamination with microbes, blood and bacterial DNA was eliminated after application of the automated reprocessor/chlorine dioxide system. Thus, chlorine dioxide is a potential alternative to glutaraldehyde. The use of automated reprocessors with compatibility to chlorine dioxide, coupled with thorough pre-cleaning, can offer effective, faster and less problematic endoscopic disinfection.

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Degradation of the Poliovirus 1 genome by chlorine dioxide.

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AIMS: This study was undertaken to gain an understanding of the factors that influence viral RNA degradation in the presence of chlorine dioxide (ClO(2)), which will be very useful in helping to define the significance of the presence of the viral genome in disinfected water. METHODS AND RESULTS: We focused our investigation on the influence of ClO(2) on extracted RNA on the one hand, and on the infectious virus on the other. Our first results show that RNA degradation, like viral inactivation, is dose dependent. The influence of the spatial organization of the targeted genomic sequence, as well as that of its size and location (and/or sequence) on degradation of the Poliovirus 1 genome by ClO(2), was studied using real-time reverse transcriptase-polymerase chain reaction (RT-PCR). The results show that the preferential sites of action of

ClO(2) appear to be located in the untranslated regions, 5'- and 3'-UTR, a phenomenon influenced by both the presence of secondary structures and the genomic sequence in these regions. Our results also reveal a rapid decrease of infectious particles quantified by the cell culture for the applied dose. Comparison between cell culture and real-time PCR for viral detection reveals disagreement following disinfection treatment, even for the largest targeted fragment (a 6,989-base fragment representing the quasi-whole viral genome). CONCLUSIONS: The detection of genome fragments is insufficient to confirm the presence of the infectious virus, as each targeted fragment shows a different sensitivity. Hence, the smallest targeted fragment (76 bp) persisted throughout the analysis period, while the longest targeted fragment (6,989 bp) disappeared very rapidly. Highly sensitive regions (i.e. 5'- and 3'-UTR) should be targeted to avoid an overestimation of the risk of viral infection using molecular biology methods in water following disinfection. Further studies in this area are needed. SIGNIFICANCE AND IMPACT OF THE STUDY: To date, it has not been possible to routinely apply virological controls to drinking water because of the time-consuming nature of the gold standard technique (cell culture) and its inability to detect all serotypes (e.g. Norovirus). Molecular techniques (e.g. real-time RT-PCR) constitute a solution to the rapid and specific detection of all the serotypes. However, ignorance of the mechanisms of viral degradation prevents the validation of PCR for the measurement of the risk of infection to humans following disinfection treatment.

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Comparison of disinfectants for biofilm, protozoa and Legionella control.

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The aim of this study was to compare the efficiency of different disinfectants applicable to Legionella control in domestic water systems. A domestic water supply simulation unit that allowed simulation of real-world conditions was developed for this purpose. The system, consisting of seven identical rigs, was used to compare treatment efficiency under equivalent conditions of system design, materials, hydraulics, water quality, temperature and initial contamination. During the study, each of six loops received continuous application of one of the following disinfectants: chlorine, electro-chlorination,

chlorine dioxide, monochloramine, ozone, or copper/silver. The seventh loop was used as a control and remained untreated. Performance evaluation of these disinfectants was based on their ability to reduce not only Legionella, but also protozoa and biofilms, which contribute to the establishment and dissemination of these bacteria in water systems, and their resistance to treatments. Regarding these criteria, chlorine dioxide and chlorine (as bleach or obtained by electro-chlorination) were the most effective treatments in this study. However, in comparison with chlorine, chlorine dioxide showed a longer residual activity in the system, which constituted an advantage in the perspective of an application to extensive pipework systems.

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Audit of nasendoscope disinfection practice.

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INTRODUCTION: Several options exist with regard to flexible pharyngo-laryngoscope sterilisation. We audited the use of disposable sheaths in our department over a six-month period. METHODS: A cost-analysis was performed and the advantages and disadvantages of this system were compared with several alternative options. RESULTS: We found that the overall cost of disposable sheaths averaged ł4008 per month over a six-month period. We subsequently introduced chlorine dioxide (ClO2) wipes as a means of disinfection. Chlorine dioxide wipes have enabled a monthly saving of ł3145 over sheath usage. Additionally, they meet health regulation requirements and are a convenient, cost-effective alternative to sheaths. DISCUSSION: The limiting factors, including time and financial issues, involved in nasendoscope disinfection are discussed. CONCLUSIONS: We have found chlorine dioxide wipes to be a satisfactory alternative means of nasendoscope disinfection. Possible time constraints aside, there are no advantages of sheath use over our current method. Chlorine dioxide wipes are also preferable from a financial point of view.

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Effect of chlorine dioxide gas on fungi and mycotoxins associated with sick building syndrome.

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The growth of indoor molds and their resulting products (e.g., spores and mycotoxins) can present health hazards for human beings. The efficacy of chlorine dioxide gas as a fumigation treatment for inactivating sick building syndrome-related fungi and their mycotoxins was evaluated. Filter papers (15 per organism) featuring growth of Stachybotrys chartarum, Chaetomium globosum, Penicillium chrysogenum, and Cladosporium cladosporioides were placed in gas chambers containing chlorine dioxide gas at either 500 or 1,000 ppm for 24 h. C. globosum was exposed to the gas both as colonies and as ascospores without asci and perithecia. After treatment, all organisms were tested for colony growth using an agar plating technique. Colonies of S. chartarum were also tested for toxicity using a yeast toxicity assay with a high specificity for trichothecene mycotoxins. Results showed that chlorine dioxide gas at both concentrations completely inactivated all organisms except for C. globosum colonies which were inactivated an average of 89%. More than 99% of ascospores of C. globosum were nonculturable. For all ascospore counts, mean test readings were lower than the controls ($P < 0.001$), indicating that some ascospores may also have been destroyed. Colonies of S. chartarum were still toxic after treatment. These data show that chlorine dioxide gas can be effective to a degree as a fumigant for the inactivation of certain fungal colonies, that the perithecia of C. globosum can play a slightly protective role for the ascospores and that S. chartarum, while affected by the fumigation treatment, still remains toxic.

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Quantitative neutralization assay of fungicidal activity of disinfectants.

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A quantitative assay using a neutralization medium was developed to evaluate fungicidal activity of disinfectants. Concentrated Dey-Engley neutralizing broth was used in this study and was demonstrated to inactivate various chemical agents within 5 min when disinfectant concentrations were reduced to specific levels. Addition of this Dey-Engley broth to test tubes containing fungal cells and disinfectants permitted control of the various interactions times. Subsequent concentration of the disinfectant-treated cells to a 1-ml final volume also permitted examination of a larger population for the presence of resistant cells. After timed exposures of 15, 30, and 60 min, only three of seven disinfectant solutions were found to be lethal for quantitative populations of 11 fungi tested. The recommended use dilution formulations of a quaternary ammonium product and an iodophor product were the least effective agents. Various fungi, including Trichophyton mentagrophytes, Epidermophyton floccosum, and Aspergillus niger, survived 30- to 60-min interactions with these disinfectant solutions. The most resistant organism encountered was Aspergillus fumigatus, which survived 60 and even 90 min of exposure to most disinfectants. Only use dilutions of a chlorine dioxide formulation, a glutaraldehyde formulation, and an ethyl alcohol product were effective against this species and all of the other fungi after a 15-min interaction.

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