

15-17 Disinfection and Sterilization

37 The Affect of Wall Mounted Computer Flat Screen Monitors on Air Quality in Operating Rooms (ORs)

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Background: As computer technology and digital imaging have advanced, there is an increasing need for computers and large flat screen monitors in the OR. Adding electronic equipment to a clean environment raises concerns about secondary affect on air quality and becoming microbial reservoirs. Computer cooling fans may increase airborne particulates concentrations, cause thermal air currents and may contaminate surgical instruments or surgical incisions.

Methods: An OR air quality study was performed to evaluate the affect of large flat screen monitors on the air flow and particulate/microbiologic concentration. Flat screen monitors were installed in two ORs on a wall above a surgical back-table for sterile surgical instruments. Three sets of tests were performed: airflow testing, including thermal imaging; particulate testing at 25 sampling room locations; and microbiologic air sampling in 3 operating rooms: 2 rooms with and a control room without a flat screen monitor. Testing was performed under 3 conditions: all OR equipment off, equipment on with monitors off and on. In addition swab cultures were also taken of CPUs, flat screen and surgical light fixture surfaces.

Results: Visual smoke and CO₂ vapor studies in ORs with flat screen monitors turned on showed no significant change in airflow compared to the control. Particulate counting at 0.02-1.0 microns did not show statistical differences for particle counts when the monitor was on versus off with counting values < 500 particles/m³. There is a strong statistical correlation between exhaust volumes, make-up air quality and OR particulate levels. Microbiologic sampling on the surgical back-table showed low CFU/500 mL (<15) when comparing ORs with monitors on or off. Additional microbiological sampling results are pending. Although air monitoring showed low microbial counts, swab sampling of computers, flat screens and surgical light fixture surfaces showed significant microbiological growth.

Conclusion: Air quality in the OR does not appear to be affected by installation of wall mounted flat screen monitors. However, overtime flat screens and computers may become reservoirs for microbes. Appropriate cleaning of OR equipment is necessary to maintain a clean environment. New OR construction should consider creative designs for installation and placement of wall mounted flat screens and electronics so as not to affect the air quality.

38 Evaluation of an Educational Campaign and a Change in the Product and Techniques Used in Cleaning Patient Rooms

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Background: Patients colonized or infected with *Clostridium difficile* (C. diff), Methicillin-resistant *Staphylococcus aureus* (MRSA) or Vancomycin-resistant enterococcus (VRE) can shed these organisms, contaminate the environment and potentially spread them to others. These organisms cause healthcare associated infections (HAIs) that contribute significantly morbidity, mortality and cost.

Objectives: To evaluate an educational intervention and a cleaner/disinfectant product, Virox Accelerated™ Hydrogen Peroxide (with microfiber cloths) and their effectiveness compared to standard cleaning in reducing HAIs.

Methods: The educational intervention was implemented on all units in June 2005. Initially, nursing staff received education on C. diff, isolation and hand hygiene. In April 2006, environmental service staff on 3 intervention units (1 ICU, 1 transplant unit and 1 intermediate care unit (IMC)) received the same education. Results were compared to two units (1 ICU and 1 transplant unit). Two different cleaning

materials were introduced: Virox (ICU and transplant unit), and microfiber cloths (IMC). Baseline HAI rates for *C. diff*, MRSA and VRE were compared to two time points: post education and after cleaning intervention. Environmental samples (ES) from rooms with isolation precautions were obtained for pre and intervention periods. *C. diff* samples, obtained using media impregnated sponges, were processed at the CDC, documented by CFUs. Samples for MRSA and VRE were obtained with transport-media dampened sterile swabs and processed at the JHH lab, documented by semi-quantitative counts.

Results: HAI rates reduced for *C. diff* in intervention units, 1.25 to 0.85/1000 PD ($p=0.26$) and VRE in intervention ICU, 1.80 to 0.39/1000 PD ($p=0.14$). In control units, there was a significant reduction in HAI VRE during the educational intervention, 11.47 to 8.06/1000 PD ($p=0.02$); this change was maintained during the intervention period 11.47 to 7.92/1000 PD ($p=0.01$). In the IMC, there was a significant HAI *C. diff* increase, 0.74 to 3.75/1000 PD and in mean *C. diff* growth, 6.00 to 1527.20 ($p=0.00$), during the intervention period. MRSA HAI rates remained relatively constant, except for an increase for the intervention ICU, 2.81 to 5.47/1000 PD ($p=0.05$). ES rates remained relatively constant, except *C. diff* rates in IMC, 16.67 to 83.33/100 samples ($p=0.14$).

Conclusions: No cleaning strategy was significantly superior, possibly due to the small sample size. HAI *C. diff* and VRE rates, and ES rates for VRE decreased with education and novel cleaning product intervention, though not significantly. Neither intervention showed an impact on MRSA rates. The unit using microfiber cloths showed increases in HAI and ES rates for both *C. diff* and VRE. Repeating this study with a greater sample size may provide more information on the effectiveness of such a campaign for preventing HAIs.

39 New Investigations on Prion Decontamination

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Background: Prions are infectious proteins implicated in a Transmissible Spongiform Encephalopathies (TSEs). Prion diseases have been shown to be transmitted via contaminated surfaces. Specific decontamination methods have been recommended due to the unique resistant nature of prions. Their remains some debate on the safety and efficacy of prion inactivation methods.

Objective: This report describes the investigations of practical methods for prion decontamination, using *in vitro* and *in vivo* test protocols.

Methods: *In vitro* and *in vivo* test methods have been developed. For *in vitro* studies, glass slides were contaminated with infected homogenates and analysed by a standard Western blot method. Different strains of prions in infected brain homogenates, including scrapie, BSE, vCJD and sCJD. For *in vivo* studies, stainless steel wires were artificially contaminated with scrapie or BSE material, dried, exposed and evaluated in animal models. Decontamination methods included cleaning with an enzymatic or alkaline detergent, thermal disinfection, steam sterilization (134C for 18 mins) and chemical sterilization with vaporized hydrogen peroxide (VHP).

Results: Enzyme-based detergents are variable in prion removal and some products can even increase prion resistance. Some products are effective due to physical removal test surfaces. An alkaline formulation was shown to remove and breakdown the prion protein at typical use conditions. Thermal inactivation can be effective, although contamination hydration is important. Initial studies suggest that some degradation of prions was observed when heated in water, but depending on the strain tested. Sterilization with VHP was effective, even in the absence of cleaning, but liquid peroxide was ineffective. The mode of action of VHP appears to cause protein unfolding and fragmentation.

Conclusions: Cleaning is recommended as an essential step, but the choice of chemistry and process will have a significant impact. Further studies are required on the effects of thermal disinfection, which may

further reduce prion contamination. Cumulatively, steam sterilization will further reduce the risk but there does not appear to be a need for higher temperatures or longer exposure times. For low temperature sterilization, a new VHP process was shown to be effective.

40 Clinical and Environmental Distribution of *Legionella spp* (LS) in an Acute Care Hospital: Long-term Efficacy of a Chlorine Dioxide (ClO₂) Potable Water Treatment System

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Background: *LS* are intracellular gram-negative pathogens that are ubiquitous in environmental water sources. Several species including *Legionella pneumophila* (*LP*) are known to cause both community and healthcare associated (HA) pneumonia. Cooling towers, hot water distribution systems and evaporative condensers in hospitals provide suitable environments for *LS* to multiply and serve as sources of nosocomial transmission. Current methods for controlling growth of *LS* in HA potable water systems include superheating, copper-silver ionization, hyperchlorination, UV light, chloramines, ozone treatment and ClO₂. In efforts to control *LS* at our institution, we installed a ClO₂ potable water treatment system in a newly constructed oncology center (2001) and in 2002 a ClO₂ system was also placed in a building constructed in 1974.

Objective: We reviewed the long-term safety and efficacy of a ClO₂ treatment system in controlling *LS* colonization of the water system and preventing nosocomial cases of *LP* pneumonia in two buildings of varying ages.

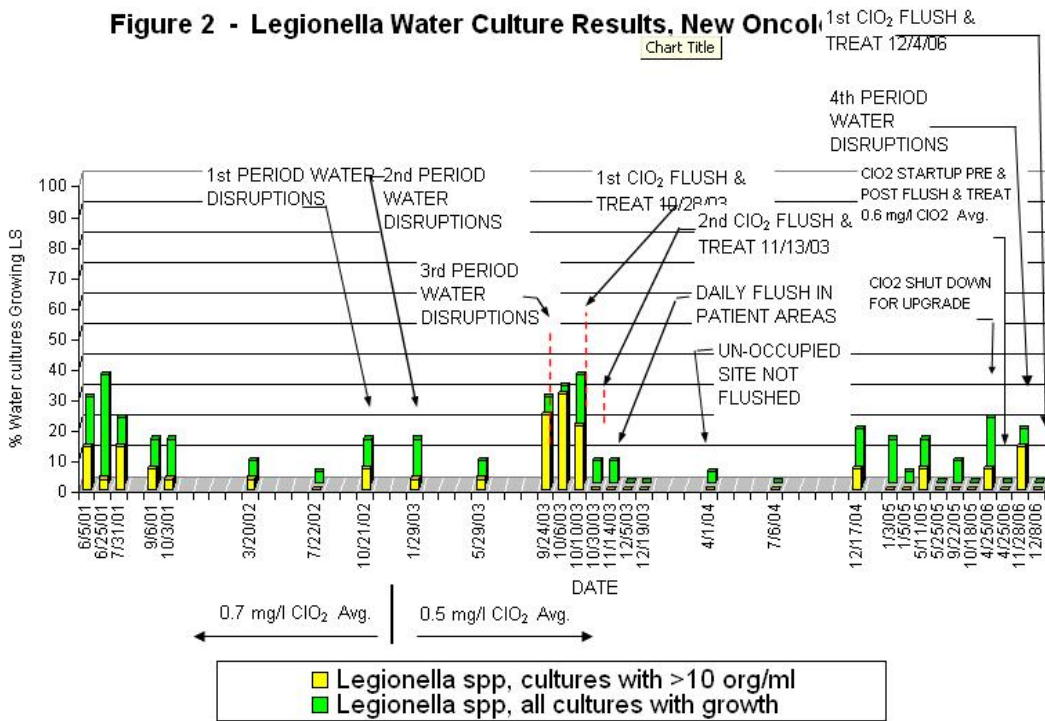
Methods: Following installation of the ClO₂ treatment system, regular water cultures were performed at multiple sites in each building. For each sample, direct and concentrated cultures for *LS* and gram negative bacteria were performed using standard microbiologic techniques. Infection control practitioners

Figure 1: Legionella Water Cultures Results, Older Building



reviewed all Legionella cultures and specimens and patient records and evaluated whether the cases met CDC criteria for probable nosocomial acquisition.

Results: In the older building, prior to initiation of the CIO₂ system, 100% of tested sites grew *LS*, more specifically *LP*. With institution of a continuous CIO₂ water treatment system in conjunction with daily flushes in patient treatment areas, the percentages of cultured sites growing *LS* and *LP* were reduced significantly ($p < 0.001$; Figure 1). Similarly a decreased percentage of cultured sites grew *LS* in the new



oncology building. (Figure 2) Spikes in cultures growing *LS* were associated with water disruptions and system outages. No significant adverse patient events occurred which could be attributed to chlorine dioxide. One

confirmed case of nosocomial *LP* pneumonia was identified between 2001 and 2006 in the older building. The timing of this case coincided with a disruption in the CIO₂ system.

Conclusions: Our results indicate that CIO₂ is both safe and effective in the short and long-term at reducing *LS* colonization in hospital potable water systems and preventing nosocomial *LP* infections.

41 Investigation of Pseudo-infections after Insertion of Cardiac Implantable Devices in an Electrophysiology (EP) Lab

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Background: The University of Pittsburgh Medical Center, Presbyterian is an 800 bed tertiary care teaching facility with 2 EP Labs performing 60-75 implantable device procedures/month. A povidone-iodine (PI) surgical scrub was the preferred skin prep. Infection Control (IC) recommended a chlorhexidine gluconate/isopropanol (CHGI) product be used as the prep. The EP staff voiced concern with this change but agreed. On 8/14/06, IC noted 4 possible EP related pocket infections occurring over a 2 month period and began an investigation. Over the next month, 3 more cases were noted.

Objective: To investigate a cluster of 7 possible infections related to insertion of implantable devices in the EP Labs.

Methods: Cases underwent chart review to include signs/symptoms, laboratory data, procedure date, EP staff, EP room, implantable device lot and serial number, sterility of equipment. EP Labs were inspected

and environmental controls evaluated. EP staff were interviewed and observed during insertion of an implantable device.

Results: All cases developed an inflammatory process including low grade fever, abrupt leukocytosis with values as high as 24K, erythema, swelling, tenderness, and purulence, 6/7 cases within 24 hours of implant, 4/7 had devices explanted. Inflammation in all cases resolved within 24 hours. Wound and blood cultures were obtained in all cases and were negative. Procedures were performed on different days. No common staff or implantable device lots or serial numbers were noted. The pre and post orders were appropriate including pre-procedure antibiotics. Sterility logs indicated all equipment had undergone appropriate processing. The EP procedure and storage areas were free from dust and documented air exchanges were within appropriate range. No staff wore rings, wrist jewelry, or artificial nails. Clippers were used. Sterile technique was noted throughout the observed procedure. Skin prep included the newly recommended CHGI product but was used after the application of the PI scrub. MSDS sheets for both were reviewed. CHGI is incompatible with oxidizing materials. The PI scrub was found to contain the oxidizing material hydrogen peroxide.

Conclusions: 1) Prospective surveillance was essential in identifying an unusual increase in EP procedure related presumed infections and triggered an immediate investigation. 2) The investigation found no breaks in policy but did note two acceptable antiseptics were used in combination. 3) Further investigation revealed these products are incompatible. 4) Their combined use was likely responsible for a chemical inflammatory reaction. 5) The PI scrub was eliminated and there were no other cases. 6) Identifying the root cause of inflammation was key in treatment options and prevented device explantation of the last 3 cases.

42 Risk of Infection Associated with Improperly Cleaned Instrument for Prostate Biopsies _ Maine, 2006

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Background: Approximately 624,000 prostate biopsies are performed annually in the United States. Risks of pathogen transmission from improperly cleaned prostate biopsy instruments are unknown. In January 2006, Hospital A discovered a lapse in its cleaning procedures, after finding debris within the needle guide lumen of the single prostate biopsy instrument used at the hospital.

Objectives: To investigate transmission of hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV) and bacteria among patients undergoing prostate biopsies, and to determine risk factors for bacterial infections.

Methods: Patients who underwent prostate biopsies from January 2003 through January 2006 at Hospital A were offered testing for HIV, HBV, and HCV infection. Cases of HIV, HBV and HCV infection were defined as positive serology post-biopsy without evidence of prior infection. Cases of bacterial infection were defined as a positive bacterial culture or at least two clinical symptoms of infection (fever, chills, pain, dysuria) \leq 14 days post-biopsy. Medical records were reviewed and patients interviewed to determine serological status pre-biopsy and risk factors for blood-borne pathogen infection. A nested case-control study was conducted for bacterial infections.

Results: Since the purchase of the instrument in January 2003, water flushing instead of the brush recommended by the manufacturer, was used to clean the needle guide lumen. From the time of purchase until discovery of the problem, 528 patients underwent prostate biopsies. Of those, 8 (1.5%) were infectious for HBV or HCV at the time of biopsy. Among 520 patients without documented infection pre-biopsy, 402 (77%) were tested for HIV, HBV, and HCV infection after biopsy. Fifteen (4%) patients had serological evidence of past HBV infection without recognized risk factors; however, they were not clustered in time around each other or after a potential source patient. No cases of HIV or HCV infection post-biopsy were identified. There were 11 (2%) cases of bacterial infections; no temporal clustering was

observed among them. Bacterial cases were more likely than controls to have nurse A in the procedure room (OR 4.7, 95% CI 1.2-18). Nurse A reported same reprocessing practices as other nurses. On June 19, 2006, after receiving reports that this same lapse in the cleaning process was occurring in other medical facilities across the country, the Food and Drug Administration issued a Public Health Notification describing the proper cleaning procedures for prostate biopsy instruments.

Conclusion: Although the prostate biopsy instrument was improperly cleaned, we found no conclusive evidence of pathogen transmission. No patients tested positive for HIV or HCV infection, and transmission of HBV and bacterial agents appear unlikely given the low prevalence we observed for these infections and absence of clustering.