

The Environment

155

Assessing Invasive Mold Infections, Mold Exposures and Personal Protective Equipment use Among Immunocompromised New Orleans Residents after Hurricane Katrina

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Background

Under typical environments, invasive mold infections (IMI) occur in approximately 1-2% of severely-immunocompromised patients annually. In September 2005, widespread flooding after Hurricane Katrina caused extensive mold contamination across most of New Orleans. Airborne molds, including the pathogen *Aspergillus fumigatus*, were detected in high concentrations in hurricane-damaged homes. Public health officials recommended that immunocompromised persons wear personal protective equipment (PPE) appropriate to exposure activity and immune status or avoid such buildings.

Objective

To identify IMIs and assess mold exposure prevention practices among a cohort of New Orleans immunocompromised residents one year post-hurricane.

Methods

We estimated mold exposures by determining activities and PPE used while in hurricane-damaged buildings among adult patients visiting Ochsner's Infusion, Hematology/Oncology and solid-organ transplant clinics from February 22-May 11, 2006. We reviewed medical records to determine immune status (profoundly-immunocompromised, other-immunocompromised or non-immunocompromised based on medications and underlying illness) and to identify IMIs. Case-patients were defined as immunocompromised patients with microbiological evidence and clinical symptoms compatible with IMI. We calculated risk ratios (RR) and 95% confidence intervals (95%CI) to assess effect of immunocompromised status on prevention practices.

Results

Among the 199 participants, the profoundly-immunocompromised patients (n=84) were more likely to avoid mold exposures than the other-immunocompromised (n=65) and non-immunocompromised (n=50)(RR=1.68; 95%CI=1.29-2.21). Of those reporting exposures, N-95 masks were worn less than 40% of the time. Profoundly-immunocompromised reported wearing N-95 respirators more often than other-immunocompromised participants (RR=1.68; 95%CI=1.29-2.21). We identified 1 IMI case-patient with *Cladosporium* (1.2% of profoundly-immunocompromised) who reported always using N-95 respirators and gloves (but not goggles) while cleaning hurricane-damaged homes prior to symptom onset. The case-patient recovered without receiving treatment for IMI. Although 3 other patients had specimen cultures with molds (*Fusarium*, *Geotrichum* and *Syncephalastrum*), none had clinical symptoms compatible with an IMI or were treated for an IMI.

Conclusions

Although post-hurricane recommendations to avoid exposures to hurricane-damaged buildings or to use PPE were not strictly followed, incidence of IMIs was not elevated among this population. These data suggest that molds associated with water-damaged buildings infrequently cause infections even in susceptible patients with unprotected exposures.

156

Fire in the Hole! Regulatory and Infection Issues Surrounding Alcohol Skin Prep Solutions in the Operating Room

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Background

Surgical fires in operating rooms (ORs), fueled by flammable products (FP) such as skin prepping agents, are significant events that can have serious consequences for patients. The National Fire Protection Association (NFPA) 1999 Standard on Healthcare Facilities dictated that liquid germicides and antiseptics, used in anesthetizing locations where electro-cautery or laser is in use, shall be non-flammable. As alcohol and alcohol-containing prep (ACP) solutions provide significant clinical benefit in reducing surgical site infection (SSI), the NFPA code elicited responses from the healthcare industry and associated professions. The American Society of Hospital Engineers (ASHE) prompted the NFPA to write a Tentative Interim Amendment (TIA) to the standard in 8/05. The TIA provided guidelines for the safe use of ACPs in ORs. Currently the Pennsylvania Department of Health (PA-DOH) uses a CMS interpretation of the '05 TIA which does not recognize allowances for ACPs. In 7/06, inspectors from the PA-DOH ordered hospitals in southwestern PA to remove all ACPs from their ORs.

Objective

To determine the effect of ACPs removal on SSI rates on a surgical service where ACPs are used as standard skin prep.

Methods

Following removal of ACPs from the OR, the SSI rate in the Neurosurgical Service (NS) where 70% alcohol had been used routinely as part of a 3-part surgical prep, was monitored for potential impact. The 8/06 SSI rate was compared to SSI rates during historical and successive time periods by Yates Chi-square testing. Surgical procedure notes from OR electronic information systems were reviewed to determine type of skin prep used. A guideline for the safe use of FPs was prepared by the OR and infection control. New guidelines were implemented and ACPs were again made generally accessible to surgeons in 9/06 using the new guidelines. Fire activity was monitored throughout the study period.

Results

The 8/06 NS SSI rate was 3.0 (10 SSIs /323 procedures) versus 0.9 (38 SSIs /4088 procedures) in the preceding 12 months and 1.2 in the next 2 months (9 SSIs/ 754 procedures). The rate increase was statistically significant when compared to the preceding 12 month baseline rate ($p=0.001$). ACPs had been eliminated from the skin prep in 5 /10 NS infections. No other protocol changes were made. No fires were

reported throughout time of study.

Conclusions

- 1.) The increased NS SSI rate occurred during the time period when ACPs were restricted in the OR.
- 2.) The change in the standard skin prep was the only change detected and was likely responsible for the increased SSI rate.
- 3.) Policies can be written to provide guidelines for the safe use of all FPs in the OR.
- 4.) Regulators need to consider potential consequences and re-direct focus to the safe use of ACPs in ORs as outlined in the NFPA TIA.

157

Environmental Contamination with Antimicrobial Resistant Organisms (MDROs)

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Background

MDROs are a significant problem in healthcare institutions, causing healthcare acquired infections (HAIs) with significant morbidity and mortality. Environmental contamination is thought to be a significant contributor to the transmission of MDROs in the hospital setting.

Objective

To investigate the extent of environmental contamination from *Clostridium difficile* (*C. diff*), Methicillin-resistant *Staphylococcus aureus* (MRSA), Vancomycin-resistant enterococcus (VRE), and multi-drug resistant *Acinetobacter spp.* (MDR-A) by obtaining surface cultures from rooms of inpatients on isolation precautions for these organisms.

Methods

From April to November 2006, 348 environmental samples obtained from “high touch” surfaces were cultured from randomly chosen inpatient rooms housing patients isolated for 1 of the above organisms. Samples for MRSA, VRE and MDR-A were collected with a transport media dampened swab and analyzed using standard microbiologic techniques, growth reported semi-quantitatively. Samples for *C. diff* were collected with a media impregnated sponge and sent to the CDC for analysis, growth reported in CFUs.

Results

Cultures grew MRSA, VRE, MDR-A and *C. diff* at rates of 8.97, 23.59, 0.33 and 36.17/100, respectively. MRSA and VRE were most often found on the bedrail (MRSA - 25.9%, VRE - 22.5%), supply cabinet (MRSA - 25.9%, VRE - 21.1%) and bedside table (MRSA - 22.2%, VRE - 14.1%). MDR-A was found on the bathroom handrail. *C. diff* was collected from the bedrail/bedside table (47.1%) and the sink/toilet (52.9%). Culture rates for samples taken from the rooms of patients isolated for that specific organism were MRSA - 23.00, VRE - 31.47, MDR-A - 8.33, and *C. diff* - 8.97/100 samples, respectively. MRSA grew from 2 samples of patients' rooms isolated for MDR-A and from 2 rooms of patients with VRE. VRE grew from 9 samples from patients' rooms

isolated for MRSA. VR-*E. faecalis* grew from 12 samples, 9 of which were from patients with either MRSA or VR-*E. faecium*. 33.3% of the total samples growing MRSA and 36.6% growing VRE were obtained from surfaces touched only by staff (supply cabinets, ICU telephones and keyboards). Of these surfaces, 39.1% were contaminated with an organism other than the patient's known isolate. And, 36.0% of these surfaces were contaminated *E. faecalis*. MRSA was found most often when the patient isolate was from a surveillance culture (52.2%) or from sputum (30.4%). VRE was found most often when the patient isolate was from a rectal swab (40.3%), endo/nasal suction (14.5%) or stool (14.5%).

Conclusions

Environmental contamination with MDROs is common and may be more important than thought in transmission to patients. The fact that organisms other than those for which the patient is isolated are found in the room needs to be addressed, and argues for increased attention to cleaning processes and hand hygiene, particularly when the contaminated surfaces are those touched only by staff.

158

Utilization of Laser Particle Counters and Spore Traps to Assess Bioaerosol Contamination in HEPA-Filtered Rooms Housing Patients with Hematologic Malignancy

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Background:

Nosocomial invasive aspergillosis is associated with high morbidity/mortality in patients with hematologic malignancy (HM), including those undergoing hematopoietic stem cell transplant. HEPA-filtered rooms under positive air flow have been shown to decrease the risk and concentration of bioaerosol contamination with *Aspergillus* species and other airborne contaminants. Various assessment methods are available for evaluating air contamination of patient rooms. Hand-held particle counters and spore traps, which collect viable and non-viable spores, were used to evaluate bioaerosol levels before and after housekeeping events.

Objective:

To evaluate the correlation between particle counters and spore traps utilizing the *Aspergillus/Penicillium* (Asp/Pen) spp. spore results and correlations between particle counts, testing the hypothesis that the particle counter could serve as an effective screening tool for air quality investigations in immunocompromised patient rooms.

Methods:

From April-October 2004, 209 spore traps and particle count measurements were taken from 72 HEPA-filtered rooms housing patients with HM in a tertiary cancer center. Samples were obtained from 105 sampling events in rooms within 30 min. of terminal decontamination and 104 sampling events in rooms where a patient had been discharged but terminal cleaning had not yet begun. Additionally, 88 spore traps were collected outside. Particle count measurements were collected concurrently with spore trap samples. The particle counter differentiates between 0.3, 0.5, 1.0, 2.0 and 5.0 μm sized particles. Spearman correlation calculations were conducted comparing the

various particle sizes and detection of Asp/Pen spores on the spore trap. Logistic regression analysis of spore trap samples was completed for patient room samples.

Results:

Of 209 indoor spore trap samples, 75 (from 44 patient rooms) were contaminated with Asp/Pen-like spores. Of 104 samples from cleaned rooms, 39 (38%) detected Asp/Pen spores. Similarly, of 105 samples from uncleaned rooms, 36 (34%) were positive for Asp/Pen spores. The median density of spores obtained from cleaned rooms was 20 spores/m³ of air, compared with 23.5 for spore trap positive samples obtained from uncleaned rooms (P = .74). Spearman correlation test showed the link between total spores and particles was significant (P < .0001). Analyses showed spore trap-contaminated density was significantly correlated with various particle sizes tested.

Conclusions:

Based on the statistical analysis, which compared particle count results collected concurrently with spore trap results, the particle counter would not provide enough differential data to determine risk of Asp exposure to a patient. Use of a particle counter does provide enough information to evaluate whether additional sampling is justified.