Best Practices in O.R.
Environmental Hygiene

Linda Homan RN, BSN, CIC
Senior Manager, Clinical and Professional Service
Ecolab Healthcare

Copyright 2013 Ecolab USA Inc. All Rights Reserved

Disclosure: Linda Homan is an employee of Ecolab Healthcare
Objectives

- Discuss the role of the environment in the transmission of pathogens
- Review current research, guidelines and recommendations in environmental hygiene
- Discuss disinfectant selection
- Compare and contrast methods to monitor environmental hygiene
- Discuss an OR environmental hygiene pilot study
Peer Reviewed Studies Supporting Use of Fluorescent Markers to Improve Environmental Hygiene in Healthcare

- Previously contaminated rooms increase transmission risk
- Many patient areas are not well cleaned
- Monitoring and feedback with DAZO fluorescent marker improves cleaning of high touch objects
- Improved surface cleaning and disinfection decreases environmental contamination
- Improved surface cleaning and disinfection decreases acquisition of pathogens

Martinez, 2003
Hayden, 2006
Huang, 2006
Hardy, 2006
Wilks, 2006
Nsei, 2006
Drees, 2008
Shaughnessy, 2011
Datta, 2011
Carling, 2006
Eckstein, 2007
Goodman, 2008
Carling, 2008
Boyce, 2009
Carling, 2010
*Jefferson, 2010
Guerrero, 2010
Loftus, 2011
Vende Leest, 2012
Carling, 2008
Goodman, 2008
Po, 2009
Bruno-Murtha, 2009
Carling, 2010
Carling, 2010
Sulis, 2010
Fitzgerald, 2011
Boyce, 2011
*Munoz-Price, 2012
Luick, 2013
Rupp, 2014
Sitzlar, 2013
Murphy, 2011
Gordon, 2014
Allen, 2015
Donskey, 2013
Hayden, 2006
Eckstein, 2007
Goodman, 2008
Hota, 2008
Dancer, 2009
Frabetti, 2009
Guerrero, 2010
Jean, 2010
*Wiemken, 2014
*Munoz-Price, 2012
Grabsh, 2012
Kundrapu, 2012
Allen, 2015
Wilson, 2011
Hayden, 2006
Wilks, 2006
Hota, 2008
Dancer, 2009
Jean, 2010
Datta, 2011
Grabsh, 2012
Orenstein, 2011
Allen, 2015

* Surgical Setting
A Novel Technique for Identifying Opportunities to Improve Environmental Hygiene in the Operating Room

JULIE JEFFERSON, MPH, RN, CIC; RITA WHELAN, RN; BRIAN DICK, MPH, MT (ASCP), CIC; PHILIP CARLING, MD

ABSTRACT

Environmental cleaning and disinfection is essential for optimizing safe patient care in the OR; however, perioperative staff members have not had an easy-to-use, objective method for determining whether high-touch, potentially contaminated surfaces have been cleaned during terminal room cleaning. To address this issue, members of the Healthcare Environmental Hygiene Study Group used a transparent, removable, environmentally stable disclosing agent and handheld ultraviolet light to determine whether potentially contaminated surfaces had been contacted by a wet disinfection cleaning cloth during terminal cleaning of ORs. Results from the project showed that 237 of 946 targeted surfaces (25%) had the disclosing agent removed (ie, were cleaned). The use of the disclosing agent for staff education and process monitoring has led to significant improvements in the disinfection cleaning process. AORN J 93 (March 2011) 358-364. © AORN, Inc. 2011. doi: 10.1016/j.aorn.2010.08.022

Pre-intervention: 25% of 946 HTOs were cleaned in the OR

The use of the fluorescent marker led to significant improvements in cleaning
Approaches to Evaluating Environmental Cleaning

**Conventional Program**
- Subjective visual assessment
- Deficiency oriented
- Episodic evaluation
- Problem feedback

**Enhanced Program**
- Objective assessment
- Performance oriented
- Ongoing cyclic monitoring
- Performance feedback
## Monitoring Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Ease of Use</th>
<th>Identifies Pathogens</th>
<th>Useful for Individual Teaching</th>
<th>Directly Evaluates Cleaning</th>
<th>Published Use in Programmatic Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Practice Observation</td>
<td>Low</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>1 Hospital</td>
</tr>
<tr>
<td>Swab cultures</td>
<td>High</td>
<td>Yes</td>
<td>Not Studied</td>
<td>Potentially</td>
<td>1 Hospital</td>
</tr>
<tr>
<td>Agar slide cultures</td>
<td>Good</td>
<td>Limited</td>
<td>Not Studied</td>
<td>Potentially</td>
<td>1 Hospital</td>
</tr>
<tr>
<td>Fluorescent gel</td>
<td>High</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>49 Hospitals</td>
</tr>
<tr>
<td>ATP system</td>
<td>High</td>
<td>No</td>
<td>Yes</td>
<td>Potentially</td>
<td>2 Hospitals</td>
</tr>
</tbody>
</table>
Quantitative Environmental Monitoring Methods

Total Aerobic Bacteria Count

- Measure of amount and type of pathogens on a surface
- Reliable, specific results
- Outbreak investigation
- Pre-cleaning culture taken of HTOs
- Post-cleaning cultures taken to measure appropriate reduction of organisms (cfu’s)
- At least 2 days before results available

References:


Guerrero D, Carling PC, Jury L, Ponnada S, Nerandzic M, Eckstein EC, Donskey C. Beyond the "Hawthorne effect": Reduction of Clostridium difficile environmental contamination through active intervention to improve cleaning practices. Abstract 60. SHEA Fifth Decennial Meeting; Atlanta, GA; March 18-22, 2010.
Quantitative Environmental Monitoring Methods

ATP (adenosine triphosphate) Measurement

- Measure of organic cellular material (ATP) on surfaces
  - Pre-cleaning swab to measure baseline organic material
  - Post-cleaning swab to evaluate organic material removal
  - Provides quick results
  - Can be used for teaching

Swab surface → luciferase tagging of ATP → Hand-held luminometer
Designed for Industrial Use

- Developed in the 1970s for commercial food preparation
- Very clean stainless steel surfaces
- High-grade disinfectants + water flushing
- Testing immediately after cleaning and just before use is the standard
- Looking for “0” Relative Light Units (RLU)

Healthcare Use

- Healthcare disinfection process does not completely remove dead organic material
- ATP measures all organic debris-microbial and non-microbial, live and dead
- Can’t expect “0” RLU. An RLU standard has not been set to define clean versus contaminated surfaces in healthcare
- Surface contaminants may artificially increase or decrease RLU Readings
  - Bleach quenches the ATP reaction
- Results vary more than 10 fold between commercially available systems
Qualitative Environmental Monitoring Methods

Visual Assessment
- Measure of visible appearance of cleanliness
- Traditional Environment of Care rounds
- Observations – overt or covert
- Limited to visible soil-can’t see pathogens
- Can be subjective
Qualitative Environmental Monitoring Methods

Fluorescent Marker

- Measure of cleaning process/thoroughness of cleaning
- Objective, accepted methodology
- Clear marker applied to HTOs after case completion
- Marker reviewed by auditor with black light after cleaning
- Removal of the mark or pattern is a “pass”. Intact or disturbed mark is a “fail”
Comparing Monitoring Methods

Comparison of fluorescent marker systems with 2 quantitative methods of assessing terminal cleaning practices

- Compared fluorescent markers, ATP monitors and aerobic colony count cultures in their ability to determine if a high touch object had been cleaned.

- Surfaces were marked with fluorescent marker and swabbed for culture and ATP before and after terminal cleaning in a very systematic way.

- Significant correlation between fluorescent marker and culture.

- Lack of correlation between ATP and culture.

<table>
<thead>
<tr>
<th>Method</th>
<th>% Cleaned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culture</td>
<td>77%</td>
</tr>
<tr>
<td>Fluorescent marker</td>
<td>76%</td>
</tr>
<tr>
<td>ATP</td>
<td>45%</td>
</tr>
</tbody>
</table>
Comparing Monitoring Methods

- Medical, Surgical, Pediatric ICU and non-ICU settings
- Using culture as gold standard, compared fluorescent markers, visual assessment, and ATP
- Fluorescent markers most closely correlated with culture in correctly identifying cleaned surfaces

Percent Classified Clean

Presented by Dr. William Rutala at APIC 2013
www.disinfectionandsterilization.org/slide-presentations/
Variability of ATP in Detecting MDROs

VARIABILITY OF ADENOSINE TRIPHOSPHATE-BASED BIOLUMINESCENCE ASSAY READINGS AMONG DRUG-RESISTANT PATHOGENS

▲ Tested ATP bioluminescence assay to assess differences among nine important bacteria

▲ ATP readings were taken from increasingly diluted samples of these organisms to determine whether the organisms could be detected at various concentrations

DETECTED - MRSA, VRE and *P. aeruginosa*

DETECTED ONLY AT HIGHEST CONCENTRATION - *E. coli, K. pneumoniae*, and ESBL-producing *K. pneumoniae*

NOT DETECTED AT ANY CONCENTRATION - KPC-producing *K. pneumoniae* and *C. difficile* spores

**Clostridium difficile Spores**

- *C. difficile* is prevalent in the environment, and spores are the most difficult to remove.
- The spore form of *C. difficile* is metabolically dormant; it does not have ATP.
- *C. difficile* is not detected by ATP technology\(^1\).
- Removal of fluorescent marker correlated well with removal of bacteria or *C. difficile* spores\(^2\).

---

What is the process for cleaning the OR?

- Top to bottom
- Clean to dirty
- Consistent pattern-clockwise or counterclockwise
Can we start cleaning before the patient leaves the room?

No. Environmental cleaning, including trash and contaminated laundry removal, should not begin until the patient has left the OR.
What type of disinfectant can be used in the OR?

OSHA's position is that EPA-registered tuberculocidal disinfectants, diluted bleach solutions and EPA-registered disinfectants that are labeled as effective against both HIV and HBV meet the requirement in the standard and are "appropriate" disinfectants to decontaminate equipment or surfaces that have come in contact with blood or OPIM provided that such surfaces have not become contaminated with agent(s) or volumes of or concentrations of agent(s) for which higher level disinfection is recommended.

Can we use alcohol wipes for cleaning surfaces in the OR?

- Alcohol alone should not be used for cleaning and disinfecting surfaces in the operating room because alcohol is not an adequate cleaning and disinfecting agent.

- It may be used as an ingredient in an EPA-registered disinfectant product if approved by a multidisciplinary team with consideration of the product's flammability.
Can we use spray disinfectants in the OR?

- The use of sprays is not recommended in the OR due to the potential to aerosolize contaminants.
- Use a pour method, saturate wipes with disinfectant or use pre-saturated wipes.
What about floors in the OR?

- Even in the best cleaning scenario, the floor is considered contaminated as soon as it is cleaned due to air currents and traffic.

- The floors and walls of operating and procedure rooms should be cleaned and disinfected after each surgical or invasive procedure if soiled or potentially soiled (e.g., by splash, splatter, or spray).

- Use a squeegee type device or gloved hand to pick up debris - No brooms

- Move the bed while mopping
Conclusion

- The environment plays an important role in the transmission of pathogens
- Increasing emphasis on environmental hygiene in published research and guidelines
- Select the right disinfectant
- Select method(s) to monitor environmental hygiene: Culture, ATP, Fluorescent Markers and Direct Observation
- An OR environmental hygiene pilot shows promise in improving thoroughness of cleaning while decreasing room turn time.
The Landscape Is Changing

Updated AORN Guidelines include Objective Monitoring and High Touch Object Cleaning.

Healthcare is moving towards Evidence-based Decision-making.

More scrutiny on the prevention of HAIs and readmissions due to Value Based Purchasing.