Cleaning, Disinfection and Sterilization

Basics of Infection Prevention
2-Day Mini-Course
May 2017
Objectives

• Describe basic principles of cleaning, disinfection, sterilization
• Identify when to use cleaning, disinfection, or sterilization
• Describe how to monitor cleaning, disinfection and sterilization processes
Terminology

• **Cleaning**
  – general removal of debris (dirt, food, feces, blood, saliva and other body secretions)
  – reduces amount of organic matter that contributes to proliferation of bacteria and viruses

• **Disinfection**
  – removes most organisms present on surfaces that can cause infection or disease

• **Sterilization**
  – the killing or removal of all organisms
Cleaning, Disinfection and Sterilization in Healthcare Settings

- Practice standards are based on Spaulding’s Classification system
- Healthcare devices and equipment designated as
  - Critical
  - Semi-critical
  - Non-critical
- Categories define level of reprocessing required
Critical Items

• Require sterilization
• Includes items that enter sterile tissue or the vascular system
• Examples include surgical instruments and accessories, biopsy forceps, cardiac and urinary catheters, implants, needles
Semi-Critical Items

- Require minimum high level disinfection (or sterilization)
- Includes items in contact with non-intact skin or mucous membranes
- Examples include respiratory therapy equipment, anesthesia equipment, flexible and laryngoscopes, bronchoscopes, GI endoscopes, cystoscopes, vaginal ultrasonic probes
- Cleaning process **must** precede high-level disinfection
Non-Critical Items

• Require intermediate-level or low-level disinfection
• Includes items in contact only with intact skin
• Examples include BP cuffs, stethoscopes, durable mobile patient equipment
Environmental Cleaning

- Patient environment can facilitate transmission of bacteria and viruses
  - By direct contact
  - On hands of healthcare personnel
- Contaminated surfaces increase potential for transmission of bacteria and viruses between patients
- Items categorized as non-critical (intermediate or low disinfection) or require cleaning only
Policy Considerations

- Include in policy all surfaces and equipment that can reasonably be expected to be contaminated by bacteria (high touch surfaces)
- Define responsibility and frequency for cleaning and disinfecting patient care equipment and surfaces
- Monitor compliance with policy
- Staff should be able to answer question “How do you know whether this item has been cleaned and/or disinfected?”
- Cleaned/disinfected items should be labeled (date/time)
High Touch Surfaces in Patient Rooms

- Considered non-critical
- Must be cleaned *then* disinfected on a regular basis
- Examples include:
  - Bedrails
  - Call bell
  - Telephones
  - TV remote
  - IV pump
  - IV poles
  - Toilet, commode chair
  - Overbed table
  - Light switches
  - Doorknobs
  - Respiratory and other bedside equipment
  - Computer keyboard
  - Chairs
Some High Touch Environmental Surfaces
Increased acquisition risk from prior room occupant 6 studies as of January 2011

- Huang: MRSA, VRE
- Hardy: MRSA
- Dress: VRE
- Shaughnessy: C. difficile
- Datta: MRSA
- Nseir: Pseudomonas
- Nseir: Acinetobacter

Average = 120%

Increased Risk of Acquisition (%)

Items Requiring *only* Cleaning

- Floors, walls, and windows
- Chairs and other furniture used by individuals who are clothed
- Private offices and other non-public, non-patient care areas
- Bed curtains should be changed when soiled and with terminal cleaning

Clarify in policy what needs to be cleaned and not necessarily disinfected
Items Requiring *only* Cleaning

Can this be cleaned?
Items Requiring *only* Cleaning
Use Microfiber for Cleaning

- Densely constructed synthetic strands $\sim\frac{1}{16}$ the diameter of a human hair
- Attracts dust, cleans $\sim50\%$ better than comparable cotton
- Easier to use, lighter, designed for repeat usage

HICPAC Disinfection & Sterilization Guideline 2008, Rutala
MICRO FIBER – the “cleaner” cleaning system
Monitor Environmental Cleaning Processes

- **Bioluminescence (outcome measure)**
  - Monitors for light emissions produced if organism present
  - Results difficult to interpret because it is unknown whether organism remains viable and thus transmissible
  - Expensive

- **Fluorescence (process measure)**
  - Monitors for chemical markers that fluoresce with ultraviolet (black) light if not removed during cleaning

- **Culturing**
  - Should *NOT* be done except during some outbreak investigations

- **Visual inspection**
  - Make routine rounds and provide feedback to frontline staff
Linens

• All linen handled as if contaminated with blood or body fluids (Standard Precautions)
  • Bag linen at point of use
  • Wear PPE when sorting and agitate minimally
• Laundry equipment must be maintained to prevent microbial contamination*
• New laundry technologies allow linen washing without requirements for hot water and chlorine
  • Hot water - 160°F x 25 min
  • Cold water - 71-77°F with 125 ppm chlorine bleach rinse or equivalent detergent
• Detergents not required to have stated anti-microbial claims*

*Manufacturer’s instructions for use must be followed
Cleaning, Disinfection, and Sterilization of Medical Instruments and Devices

You CANNOT achieve disinfection or sterilization without pre-cleaning

- As organic material dilutes disinfectants, bioburden must be reduced for processes to be effective

Clean all medical instruments and devices as a first step

- Remove visible soil
- May need to disconnect or separate instrument parts
- Avoid organic material drying on equipment by rinsing or soaking in an enzymatic solution
Personal Protection

When cleaning soiled medical instruments, wear

- Long sleeved impervious gown
- Eyewear
- Mask or mask with face shield
- Gloves
- Cap
- Chemical goggles (when mixing or changing solution)
Disinfection

• Eliminates or kills most bacteria, many virus types, some fungi (not prions)
• Cannot be accomplished without first cleaning
• Time-dependent process
• Levels of disinfection - high, intermediate, or low
• Hospitals must use EPA-approved product for desired level of disinfection
  • Has minimally a tuberculocidal label claim
Disinfection - continued

- Follow manufacturer’s recommendations to achieve disinfection and to avoid medical device damage method
  - Use correct dilution – more is not better!
  - Use correct contact time
  - Use correct temperature

- Understand employee and environmental safety issues
  - Do not exceed exposure limits
  - Know permissible exposure levels
  - Assess compatibility with gloves, basins, other products
EPA Registration of Disinfectants

- Labeled as high level vs. intermediate vs. low level
- May include degrees of approval
  - Limited approval, e.g. kills Hepatitis B and HIV but not approved for spores
- Select disinfectant based on what you are trying to accomplish
  - Environmental vs. medical device disinfection
- Search EPA website by product name
  
  www.epa.gov/oppad001/chemregindex.htm
High-level Disinfection

• EPA approved products include gluteraldehyde, ortho-phthaldehyde (OPA), peracetic acid & hydrogen peroxide
• Ensure achievement of temperature requirements
• Test product prior to each use
  • Can get diluted with frequent use
  • Follow facility policy
  • Test strips expire; monitor dates
• Change product as indicated by test and as manufacturer requires
• Maintain log records
• Ensure competency of staff
Environmental Disinfectants

- Phenolics
  - “Gold Standard” in healthcare
  - Toxicity concerns prohibit use in nurseries, NICU
  - Does not kill spores

- Quaternary ammonium compounds
  - Approved for specific pathogens (read the label!)
  - Affected by water hardness
  - Affected by bioburden
  - PPE use required (estrogen-like effect with contact, use gloves)
    

Correct dilution and wet contact time is critical to effectiveness.
Environmental Disinfectants - continued

• Iodophors
  • Can be used in food preparation areas
  • Inactivated by organic materials, e.g. blood
  • Can stain surfaces

• Chlorine (bleach)
  • Inactivated by organic materials, e.g. blood
  • Kills spores, e.g. *C. difficile*
  • Corrosive
  • Highly toxic (deadly) if combined with ammonia
Environmental Disinfectants - continued

- Disinfectant spray-fog techniques for antimicrobial control in hospital rooms
  - Unsatisfactory method of decontaminating air and surfaces
  - Not recommended for general infection control in routine patient-care areas

- Ultraviolet Radiation
  - Dependent on strength and duration of exposure to light, ‘line of sight’, how well microorganism can withstand UV
  - Limited to destruction of airborne organisms, inactivation of microorganisms on surfaces, and water purification

HICPAC Disinfection & Sterilization Guideline 2008
Sterilization

Achieved by

- Steam
- Dry Heat
- Ethylene Oxide
- Peracetic Acid
- Plasma Gas (vaporized hydrogen peroxide)
- Glutaraldehyde (using higher concentrations and exposure times than for high-level disinfection)
Steam Sterilization - Autoclave

- Achieves rapid heating and penetration
  - Short exposure times (<20 minutes) but temperature must be maintained throughout
  - No toxicity to workers
  - Inexpensive
  - Can damage delicate instruments

- Items to be sterilized must be
  - Clean and free of protein (blood) or other organic material
  - Packaged so that the steam can penetrate

- Autoclave must be loaded correctly
Rapid Cycle or Immediate Use

- “Unwrapped” steam sterilization
- Should only be used when absolutely necessary
  - Do not flash whole trays of instruments
  - Items must be used immediately
  - Avoid flash sterilization by keeping adequate supply of frequently dropped items
- Maintain records or “flash logs”
  - Include all implants
  - Requires same monitoring processes as routine steam sterilization in hospital
  - Use to support need for additional instruments
Monitoring Sterilization

- **Mechanical Indicators**
  - Gauges, displays, printouts
  - Indicates if device working properly
  - Not indicator of sterility

- **Chemical Indicators**
  - Change color with timed exposure to heat, steam
  - Not indicator of sterility
  - Used to show items have gone through sterilization process

- **Biological Indicators**
  - Indicator of sterility
  - Demonstrates bacterial spores on test strips or in vials/containers have all been killed
  - Results can be available in 1 hour
Storage of Sterile Items

- Protect sterility until ready to use
  - Store to protect packages from dust, moisture, falling on floor
  - Transport only covered, dry packages
  - Handle to protect package integrity
    - Refrain from crushing packages or ‘rubber-banding’ them for storage
    - Wrap sharp points in gauze

- Rotate sterile items first in, first out

- Store and label for effective recall system

- Expiration date vs. Event-related sterilization
  - Needs a program flex from L&C
IP Role in Cleaning, Disinfection, and Sterilization

- Know the processes; update the policies
- Know directors of environmental services, sterile processing, operating room, endoscope services
- Know where all sterilization and disinfection is being done
  - May include
    - Radiology
    - GI dept
    - Cardiac cath lab
    - Wound care center
    - Outpatient clinics
    - Emergency room
    - Same day procedures
    - Ambulatory surgery
- Ensure staff know and follow contact times for products
  - Per manufacturer guidelines; on labels
Questions?
Thank you