

Welcome to *California*



Cleaning, Disinfection, and Sterilization



Basics of Infection Prevention
2-Day Mini-Course
2013

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

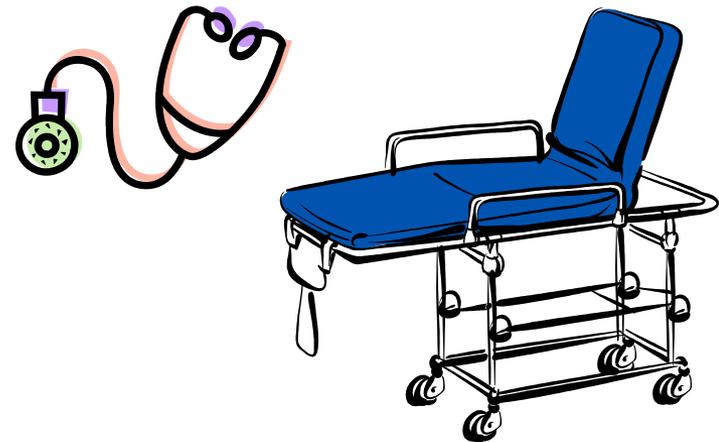


Semi-Critical Items

- 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

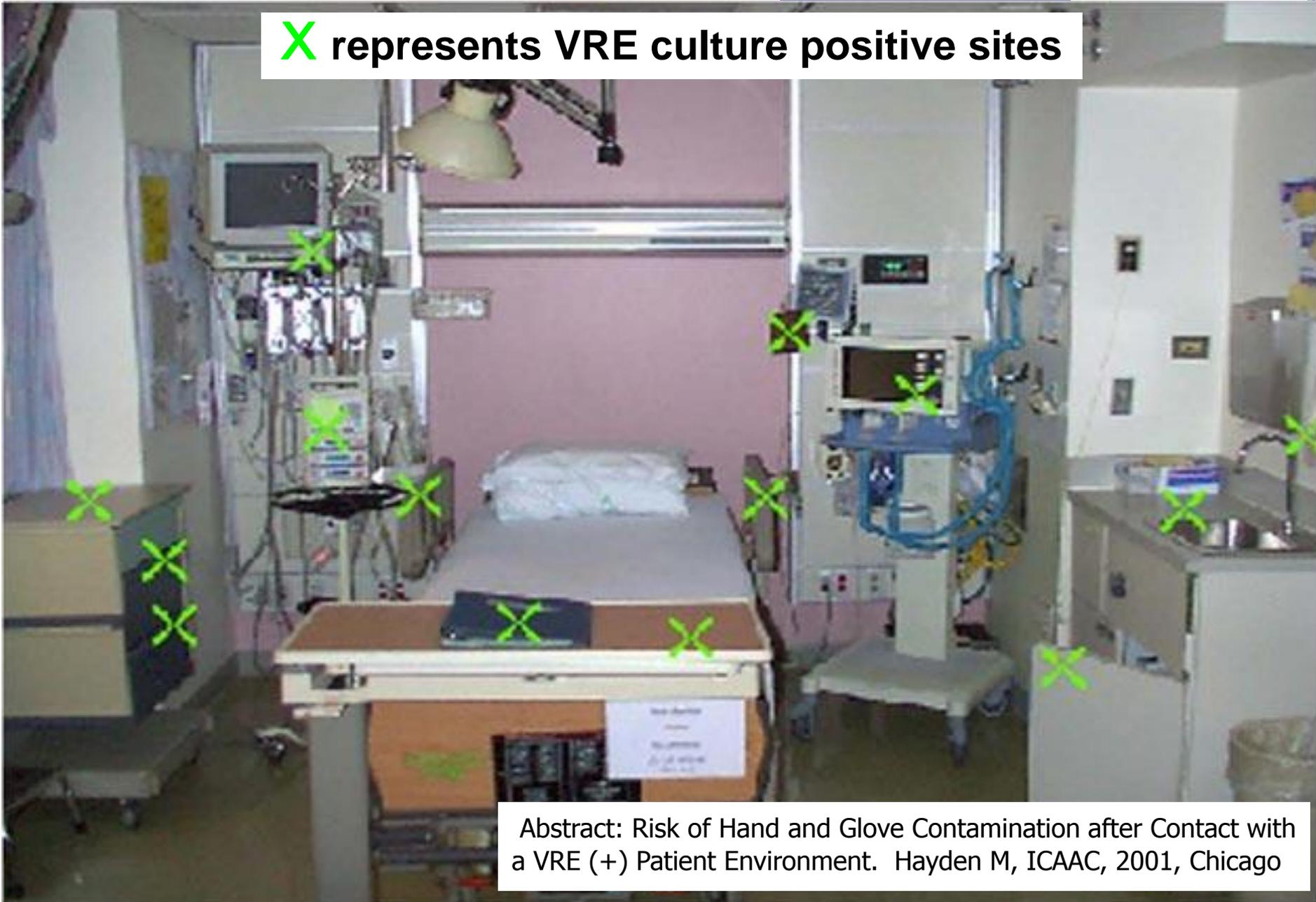


Environmental Cleaning



- 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

X represents VRE culture positive sites



Abstract: Risk of Hand and Glove Contamination after Contact with a VRE (+) Patient Environment. Hayden M, ICAAC, 2001, Chicago

Policy Considerations

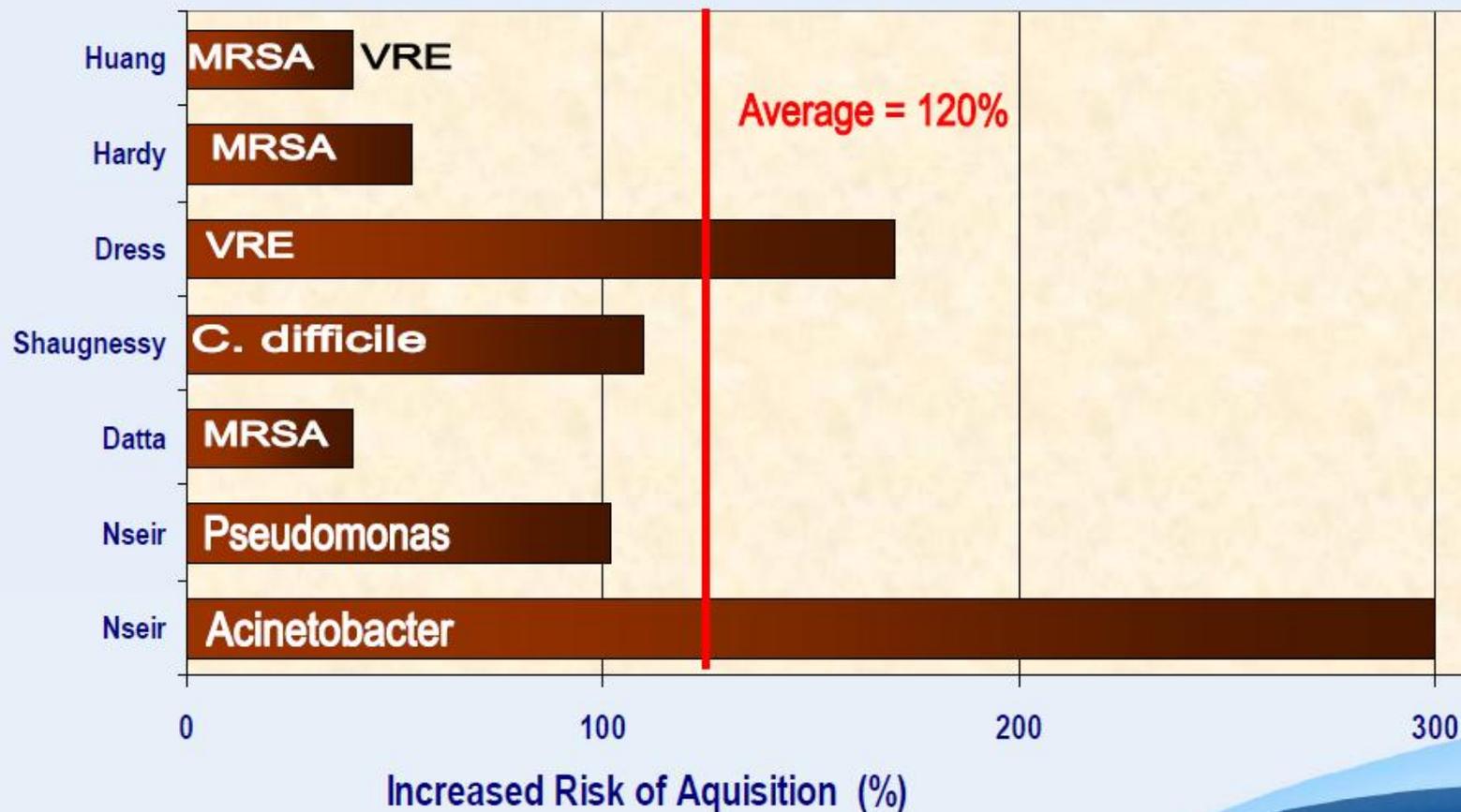
- Include in policy all surfaces and equipment that can reasonably be expected to be contaminated by bacteria (high touch surfaces)
- Define responsibility and frequency for cleaning and disinfecting patient care equipment and surfaces
- Monitor compliance with policy
- Staff should be able to answer 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



Increased acquisition risk from prior room occupant 6 studies as of January 2011



-Carling PC, Bartley JM. Am J Infect Control 2010;38 S41-50.

Items Requiring *only* Cleaning

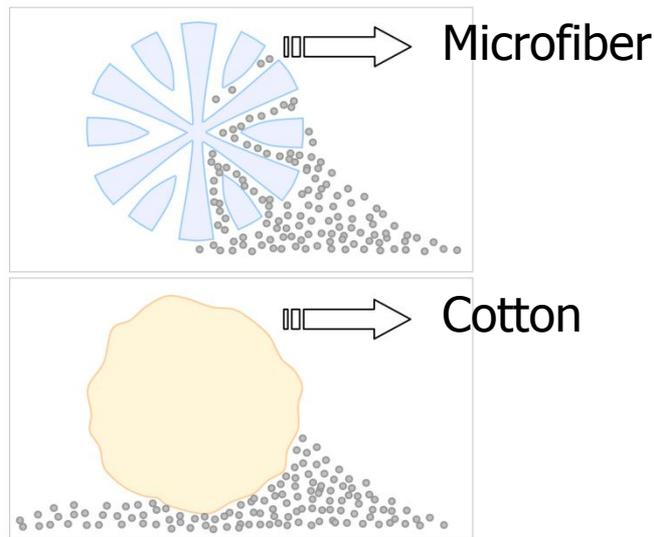
- Floors, walls, and windows
- Chairs and other furniture used by individuals who are clothed
- Private offices and other non-public, non-patient care areas
- Bed curtains should be changed when soiled and w/ terminal cleaning

Clarify in policy what needs to be cleaned and not necessarily disinfected



Use Microfiber for Cleaning

- Densely constructed synthetic strands $\sim 1/16^{\text{th}}$ the diameter of a human hair
- Attracts dust, cleans $\sim 50\%$ better than comparable cotton
- Easier to use, lighter, designed for repeat usage



HICPAC Disinfection &
Sterilization Guideline
2008, Rutala

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*



CDPH
California Department of
Public Health

HAI
Elimination

*Manufacturer's instructions for use must be followed.



CALIFORNIA APIC
LOCAL INFECTION CONTROL

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

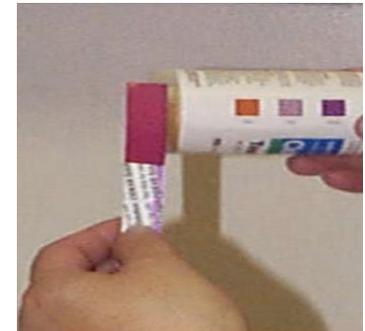
- Labeled as high level vs. intermediate vs. low level
- May include degrees of approval
 - Limited approval, e.g. kills Hepatitis B and HIV but not approved for spores
- Select disinfectant based on what you are trying to accomplish
 - Environmental vs. medical device disinfection
- Can search EPA website by product name

www.epa.gov/oppad001/chemregindex.htm



High-level Disinfection - Glutaraldehyde

- 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



Endoscopes/Bronchoscopes

- United States
 - Infection: 1/1.8 million procedures
- Professional organization guidelines
 - Minimum high-level disinfection
 - Ensure competency of personnel performing process
- Outbreaks associated with failure to comply with guidelines for disinfection/sterilization

Ambulatory and Inpatient procedures in the US, 1996. CDC 1998:1-39
Ambulatory Surgery in the United States, 2006. NHR Number 11.26pp



Endoscopy/Bronchoscopy Associated Infections

- Endoscopy
 - >280 Infections transmitted, some fatal
 - >70%: *Salmonella* and *Pseudomonas aeruginosa* (others: HBV, *Strongyloides stercoralis*, *H. pylori*, *Trichosporan*)
- Bronchoscopy
 - >90 documented infections transmitted
 - Mycobacteria, *Pseudomonas aeruginosa*
 - Mycobacteria are resistant to many disinfectants
- High level disinfectants
 - 2% glutaraldehyde at 20 for 20min is most common



Spach DE, Ann Intern Med 1993; 118: 1117-128
Weber, DJ, Rutala WA. ICHE 2001; 22:403-408



The 5 Steps of Endoscope Re-Processing

1. Clean

- Remove debris/tissue which can impede disinfection process, flush all lumens (water & enzymatic cleaner)

2. High Level Disinfection

- Perfuse through ALL channels with disinfectant

3. Rinse

- Sterile or filtered water/tap water followed by alcohol rinse

4. Dry

- Forced air

5. Store

- Hang vertically – Promote drying & Avoid recontamination

The 5 steps of Endoscope Re-Processing - continued

- To avoid problems, the 5 steps must be performed in sequence
- Do not skip, bypass, shortcut any of the 5 steps

Factors Leading to Outbreaks from Endoscope/Bronchoscope Contamination

- Contaminated water supply
- Contaminated brushes for cleaning scope lumens
- Improper manual cleaning prior to disinfection
- Biofilm inside automatic washer
- Improper use of automatic washer
- Contaminated or expired disinfection reagent
- Inability or neglect to clean the suction channel
- Mechanical or design issues related to the endoscope/bronchoscope

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



Correct dilution 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



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 Flash Sterilization

- “Unwrapped” steam sterilization
- Should only be used when necessary
 - **Do not flash whole trays of instruments**
 - Items must be used immediately
 - Avoid 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
- 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?

For more information, please contact any
HAI Liaison Team member

Thank you

