Decontamination, Disinfection, and Sterilization

Marjorie Wall, MLOS, CHL, CIS, CRCST, ASQ CSSBB
Corporate Director of Sterile Processing
Citrus Valley Health Partners

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mmawall@msn.com
714-316-4452
Objectives

At the end of this lecture, participants will be able to:

• Discuss facility, personnel and decontamination best practices for instrument reprocessing.
• Explain instrument preparation, sterilization and sterile storage best practices.
• Identify basic steps for high-level disinfection of flexible gastrointestinal endoscopes.
Why Should Infection Control Partner with SPD?
Governing Standards

In the United States, AAMI, AORN, and the CDC set the guidelines and best practices for instrument reprocessing.
## ASHRAE 170

### SPD Facility Requirements

<table>
<thead>
<tr>
<th>Functional Area</th>
<th>Airflow</th>
<th>Air Exchanges</th>
<th>Exhausted Outdoors</th>
<th>Temperature</th>
<th>Relative Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soiled/Decontaminated</td>
<td>Negative</td>
<td>10</td>
<td>Yes</td>
<td>60-65F</td>
<td>20%-60%</td>
</tr>
<tr>
<td>Sterilizer Equipment Access</td>
<td>Negative</td>
<td>10</td>
<td>Yes</td>
<td>75-85F</td>
<td>20%-60%</td>
</tr>
<tr>
<td>Sterilizer Loading/ Unloading</td>
<td>Positive</td>
<td>10</td>
<td>Yes</td>
<td>68-73F</td>
<td>20%-60%</td>
</tr>
<tr>
<td>Restrooms/Housekeeping</td>
<td>Negative</td>
<td>10</td>
<td>Yes</td>
<td>68-73F</td>
<td>20%-60%</td>
</tr>
<tr>
<td>Preparation and Packaging</td>
<td>Positive</td>
<td>10</td>
<td>No</td>
<td>68-73F</td>
<td>20%-60%</td>
</tr>
<tr>
<td>Textile Packaging Room</td>
<td>Positive</td>
<td>10</td>
<td>No</td>
<td>68-73F</td>
<td>20%-60%</td>
</tr>
<tr>
<td>Clean/Sterile Storage</td>
<td>Positive</td>
<td>4</td>
<td>No</td>
<td>≤75F</td>
<td>≤70%</td>
</tr>
</tbody>
</table>

*AAMI and AORN now defer to ASHRAE Standards. Organization is held to the ASHRAE standard at the time of installation or last major remodel.*
Facility Design

- Clean and Dirty Areas must be physically separated or 36” apart.
- People flow must move from clean to dirty.
- Equipment flow must move from dirty to clean.

NO CROSS CONTAMINATION!!
Environmental Consideration

- Floors and horizontal work surfaces
  - Clean and disinfect daily
  - Floor should be seamless, not grout
- Walls and storage shelves should be cleaned regularly on a scheduled basis.
- Ceilings and walls should be made of non-shedding and non-porous materials.
SPD Staff Deliver tray to appropriate storage area.

Sterile Storage Tray is stored in the OR ready for the next patient!

OR Staff SPD Staff Instruments are sterilized according to the manufacturer IFU.

Sterilization Tray is sterilized, ready for storage.

SPD Staff

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Input</th>
<th>Process</th>
<th>Output</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgeon's Office</td>
<td>Request to schedule procedure</td>
<td>Surgical Procedure Scheduled</td>
<td>Surgical Procedure is Scheduled in Meditech</td>
<td>SPD Staff</td>
</tr>
</tbody>
</table>

SPD Staff OR Staff SPD Prints Pick List, pulls supplies and trays. OR Staff pick special items.

Surgical Case Cart Picked Complete Case Cart is Picked and Staged in Surgery.

OR Staff Opens supplies and instruments for the surgical procedure.

Sterile Field Opened for Surgery OR Room is open and ready for surgical procedure.
Effective Cleaning CANNOT Take Place Without Effective Pre-cleaning

Why is that?

• Precleaning prevents formation of BIOFILM.

• Biofilm is “a group of microorganisms that form on a solid surface that comes in contact with water.”

• Biofilm can harbor resistant microorganisms reducing the effectiveness of high level disinfection or sterilization.
Cleaning Starts on the Procedural Field

- Wipe instruments using a sterile, water moistened sponge.
- Instruments with lumens should be flushed with sterile water.
- Saline, bleach, or other solutions should NEVER be used.
Pre-cleaning prevents damage of instrumentation and equipment.

- Dried blood is corrosive and causes pitting, rusting, and metal fatigue.
- Damaged instruments and equipment is unsafe to use on patients and can harbor microorganisms.
Immediately or as soon as possible after use, contaminated reusable sharps shall be placed in appropriate containers until properly reprocessed.

These containers shall be:
- Puncture resistant
- Labeled or color-coded in accordance with this standard
- Leak proof on the sides and bottom
Decontamination PPE

SEQUENCE FOR PUTTING ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE worn will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

1. GOWN
   - Fully cover torso from neck to knees, arms to end of wrists, and wrap around the back.
   - Fasten in back of neck and waist.

2. MASK OR RESPIRATOR
   - Secure tie or elastic bands at middle of head and neck.
   - Fit flexible band to nose bridge.
   - Fit snug to face and below chin.
   - Fit check respirator.

3. GOGGLES OR FACE SHIELD
   - Place over nose and eyes and adjust to fit.

4. GLOVES
   - Extend to cover wrist of isolation gown.

USE SAFE WORK PRACTICES TO PROTECT YOURSELF AND LIMIT THE SPREAD OF CONTAMINATION

- Keep hands away from face.
- Limit surfaces touched.
- Change gloves when torn or heavily contaminated.
- Perform hand hygiene.

SEQUENCE FOR REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)

Except for respirator, remove PPE at doorway or in anteroom. Remove respirator after leaving patient room and closing door.

1. GLOVES
   - Outside of gloves is contaminated.
   - Grasp outside of glove with opposite gloved hand; pull off.
   - Inside of removed glove in gloved hand.
   - Slide fingers of ungloved hand under remaining glove at wrist.
   - Peel glove off over first glove.
   - Discard gloves in waste container.

2. GOGGLES OR FACE SHIELD
   - Outside of goggles or face shield is contaminated.
   - To remove, handle by headband or ear piece.
   - Place in designated receptacle for reprocessing or in waste container.

2. GOWN
   - Gown front and sleeves are contaminated.
   - Unfasten ties.
   - Pull away from neck and shoulders, brushing inside of gown out.
   - Turn gown inside out.
   - Fold or roll into a bundle and discard.

4. MASK OR RESPIRATOR
   - Do not put mask respirator in waste container.
   - Grasp bottom, then top ties or elastic and remove.
   - Discard in waste container.

PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE.
Decontamination Chemicals

- Enzymatic?
- Validate dosing accuracy
- Validate NOT expired
- Validate approved by OEM
- No topping off
Brushing of Instruments

- Nylon brushes are used to remove debris from instruments.
- Brushing should occur as follows:
  - Under water line to prevent aerosolization.
  - Brush all serrations
  - Brush all hinges.
  - Brush all lumens
Decontamination
Ultrasonic Cleaning

Fig. 1 - Illustration of an imploding cavity in a liquid irradiated with ultrasound

Wash-Checks® U
Ultrasonic Monitor
Blue disappears when clean
Blue reappears when dirty
Decontamination
Automated Cleaning

• Place instruments in a position ensuring maximum exposed surface area through the automated wash process.

• Stringer should be placed so that hinged instruments are held in the open position.
Decontamination QA Testing
Assembly Inspection

- Check each instrument for the following:
  - Corrosion
  - Rust
  - Pitting
  - Cracks
  - Burrs
  - Sign of wear
- If any of the above are found, remove the instrument from service.
Assembly Inspection

- Check each instrument for functionality:
  - Scopes
    - Visual inspect lens for cracks or water penetration
    - Verify optics not damaged
  - Cameras
    - Verify prisms not cracked or wet internally
    - Check for damaged cords
  - Light Sources
    - Verify fiber optics not damaged
### Assembly Stains

<table>
<thead>
<tr>
<th>Stain Color</th>
<th>Probable Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown/Orange Stains</td>
<td>High pH - improper soaps, baked on blood, soaking in saline or using laundry soap (usually is not rust)</td>
</tr>
<tr>
<td>Bluish-Black Stains</td>
<td>Exposure to saline, blood or potassium chloride Reverse plating if two types of metals are placed in ultrasonic together</td>
</tr>
<tr>
<td>Light and Dark Spots</td>
<td>Water spots from allowing instrument to air dry</td>
</tr>
<tr>
<td>Dark Brown/Black Stains</td>
<td>Low pH acid stain - detergents or dried blood</td>
</tr>
<tr>
<td>Multi-Color Stains</td>
<td>Excessive heat - “hot spots” in autoclave</td>
</tr>
<tr>
<td>Bluish-Gray Stains</td>
<td>Cold sterilization solution used outside manufacturer guidelines</td>
</tr>
</tbody>
</table>
Assembly
Chemical Integrators
Packaging Peel Pouches

- Size of peel pouch: 1” around instrument.
- Handle located by chevron.
- Chemical integrator included.
- Tip protector if appropriate.
- Double peel pack only if validated.
- Do not overload with too many instruments.
- Do not use inside trays.
- Sterilize paper to plastic on side.
Packaging
Polypropylene Wrap

FIG. 4A

STERIPROTECT
INSTRUMENT TRAY CORNER PROTECTOR

Reusable
Please return to SPD for processing

FIG. 4C

FIG. 4B

FIG. 4D

Smarter. By design.

FIG. 4E
Packaging Rigid Containers
Assembly QA

- OR leadership documents tray defects in SPM.
- When process out of control, partner with SPD leadership to fix.
IUSS Sterilization

- Rapid sterilization process for emergency use
- Instruments must be validated by OEM
- Implants should not be IUSS’d
- Transport in a closed container
- Can be wet
- Tray cannot be stored for another patient
AAMI removed parameters, follow instrument manufacturer’s instructions for use/validated sterilization parameters.

- Must not be wet.
- Load Configuration:
  - Linen
  - Peel pouches
  - Wrapped items
  - Rigid containers
Required Testing:
- Bowie Dick Test 1st load daily
- Biological for weakest cycle weekly
- Biological in every implant load
Sterilizer Qualification Testing
- 3 consecutive Biological Tests
- 3 consecutive Bowie Dick Tests
Document lot number and expiration date
Start a new control daily or when lot number changes
Low Temperature Sterilization

- H2O2 based technology
  - Plasma or Vaporized
- Used for heat sensitive items
- Only items validated for cycle can be ran
- Weight restrictions on loads
- No porous or absorbent materials
- Only use validated chemical integrators and tape.
Sterile Integrity

- Items should be stored as not to crush, compress, puncture or compromise sterility of contents.
- Whenever there is a question as to whether the package is sterile or not, it is considered unsterile.
Sterile Storage

- Configure so wrapped Trays are not stacked
- Items are stored ergonomically correct
Sterile Transport

- Sterile trays should be covered during transport to protect from contamination.
- Trays should be handled minimally to prevent damage to packaging.
Robotic Inst Considerations

- Davinci Robotic Instruments require special processes to clean and sterilize.
- Routine direct observation competencies
- Specialized sonic washer
- Specialized rigid containers and wraps
- Robotic check for QA
TASS Considerations

- Multiple outbreaks
- RCA completed
- Enzymatic detergents
- Eye Instruments MUST go through a full rinse, preferably with deionized water.
- Lumens must be flushed with water profusely prior to sterilization
CJD Considerations

- CJD Risk for any procedures involving dura matter, spinal fluid, back of eye
- If unknown, treat as CJD.
- Process required for surgery to communicate to SPD
- Internal risk assessment for how to handle trays
- Single Use Instruments?
- CJD Cycle: 134C for 18 minutes
Flexible Scopes Standards

https://www.cdc.gov/hicpac/recommendations/flexible-endoscope-reprocessing.html
Flexible Scopes
Point of Use Cleaning
Flexible Scopes Processing Steps

Follow the OEM IFU!

1. Pre-Clean scope
2. Leak Test scope
3. Manual clean
   • Follow directions exactly.
   • Includes: brushing, flushing, and or suctioning
4. Rinse after cleaning
5. Visual inspection
6. High level disinfection
7. Rinse after HLD
8. Dry (alcohol if required by OEM)
9. Storage
Flexible Scope Decontamination

- Three Bay Sink
  - Sink 1 Leak Test
  - Sink 2 Soak/Brush/Flush
  - Sink 3 Rinse
- Dirty to clean flow
- 36” or physical barrier between dirty and clean
- Same PPE and chemical requirements as SPD
Manual High Level Disinfection

- Ensure chemical is validated by Scope OEM
- Manual solutions require specific time, temperature, and length of use following manufacturer IFU.
Manual
High Level Disinfection

- Chemical may require activation.
- Date chemical opened and date expired after opening.
- Chemical strip opening and testing.
- After expiration, chemical may need to be neutralized prior to disposal.
- PPE should always be worn when handling chemicals.
- Never top off.
- Have a spill kit and eye wash.
Manual High Level Disinfection

- Scope must stay fully submerged for OEM required time
- Temperature must meet OEM requirement
- Rinse must be completed with sterile or filtered water according to OEM
Automated Endoscope Reprocessor HLD

- Ensure your scope is validated for your machine.
- Ensure you have all required attachments
- Scope washers do not replace manual cleaning
Automated Endoscope Reprocessor HLD

- Machine should be self disinfecting
- No residual water should remain in hoses and reservoirs
- Cycles for alcohol flushing and forced air drying are desirable
- Self contained or external water filtration system
- Follow scope OEM and AER OEM instructions exactly
High Level Disinfection Documentation

- GI Scope Processing must be traceable between patients
- Time between steps documentation is monitored by some OEMs
  - If too much time elapses, extended processing is required.
- Leak Testing pass or fail must be documented
  - If failed, scope must be sent out for repair
- Chemical strip test should be completed and documented daily and on each cycle.
- Temperature of chemical solution
- Exposure time of chemical solution
Flexible Scopes Storage

- Storage cabinets should be made of a material that can be disinfected.
- In conventional storage (no drying options) scopes are hung vertically to facilitate drying.
- When using drying cabinets, follow OEM IFU for how to position scopes.
Flexible Scopes Storage

• Removable buttons and valves should be reprocessed and stored with the scope as a unique set for tracking patient to patient.
• Hung scopes should not come in contact with each other, and gloves should always be worn to prevent cross contamination.
• Do a Risk Assessment for Hang Time
so much MORE than CLEAN